ANNALS

OF THE

ROYAL BOTANIC GARDEN, CALCUTTA.

Vol. XII.

PART II.

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PART II.

ASIATIC PALMS—LEPIDOCARYEÆ

By

Dr. ODOARDO BECCARI.

PART III.

THE SPECIES OF THE GENERA.

CERATOLOBUS, CALOSPATHA, PLECTOMIA, PLECTOMIOPSIS, MYRIALEPIS, ZALACCA, PIGAFETTA, KORTHALSIA METROXYLON, EUGEISSONA.

With 120 plates and 6 plates of analytical figures.

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TO THE MEMORY OF

THE LATE

Sir George King, K.C.I.E., F.R.S., F.L.S.,

SUPERINTENDENT OF THE ROYAL BOTANIC GARDEN, CALCUTTA,

FROM 1871 TO 1898

AND

FOUNDER OF THE ANNALS THEREOF,

IN GRATITUDE FOR THE GENEROUS APPRECIATION AND AID

THAT ENABLED THESE RESEARCHES ON PALMS

TO BE PUBLISHED.

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CERATOLOBUS Bl.

Bl. in Roem. et Sch. Syst. Veg. vii, 1334 and Rumphia, ii, 165, t. 137 f. A; Mart. Hist. Nat. Palm iii, 196, t. 115, i; Miq. Fl. Ind. Bat. iii, 73; Hook. f. Fl Brit. Ind. vi, 187; Ridley, Mat. Fl. Mal. Penins. ii, 477.

Slender, climbing, more or less spinose or aculeate, polycarpic, dioecious palms, bearing lateral inflorescences. *Leaves* alternate, pinnate, terminating in a leaflet in the young plants and in a clawed cirrus in the adult ones. *Leaflets* commonly cuneately rhomboidal or cuneately oblong, their upper margin lobulate premorse, radiately veined (*Euceratolobus*), more rarely unicostate and linear or narrowly lanceolate and acuminate (*Cryptocladus*), never ansate, directly attached to the rhachis by an acute base. *Stem* with internodes covered at first with sheaths, forming the basal portion of the leaves. *Leaf-sheaths* complete and cylindrical, gibbous above, more or less spinose, not furnished with a flagellum and not ocreate, having at the mouth only a membranous and at length deciduous rim, and a small axillary ligula. *Spadices* dioecious (male and polygamous) attached to the sheaths laterally exactly similar externally in both sexes, composed of a panicle enveloped by one complete spathe only. *Spathes* persistent, dry, papyraceous or thinly coriaceous, narrowly elliptical or fusiform, unarmed, beaked, strongly flattened, two-edged or almost two-winged, entirely closed all round, except at apex during the anthesis, at times at length splitting alongside. *Panicles* of both sexes similar, contracted and always completely shut into their respective spathes, also during the anthesis, and not lengthening out afterwards, branched; the main axis and branches provided with short, tubular, tightly sheathing or infundibuliform spathes becoming bracteiform in the ultimate branchlets. *Male panicle* twice or 3 times branched. *Male flowers* solitary, suffulted by a spathel shortly infundibuliform, and provided with an involucre shallowly cupular; the calyx small, 3-toothed; the corolla split nearly to the base into 3 oblong segments callose at the base; stamens 6, with filaments adnate to the base of the corolla and having a linear free part shortly inflected at apex; anthers linear-sagittate, dorsifixed; pistillode very minute. *Female* (or *polygamous*) *spadix* less branched than the male; the branchlets bear the flowers in pairs at each flexure, every female flower being accompanied by a male (or neuter) and suffulted by an involucrophorum and an involucre, at times bracteiform; the insertion of the neuter flower is marked by a small punctiform areola. *Female flowers* ovoid, or ovoid-trigonous pyramidate; the calyx cyathiform or campanulate, 3-toothed or 3-lobed; the corolla is parted below the middle into 3 triangular segments and is ventricose in its lower part; the staminal filaments are connate with the undivided part of the corolla and carry well-formed sterile anthers; ovary globose or ovoid, covered with large fimbriate scales; style none; stigmas elongate-trigonous, thickish, recurved. *Companion male* (or *neuter?*) *flowers* very much the same as the fertile male ones. *Fruit* globose or ovoid, beaked, one celled, one seeded, clothed with appressed scales.

Seed erect, globose or oblong, enveloped with a scanty fleshy integument ; the nucleus has a pitted surface and is foveolate on the side of the chalaza ; albumen ruminate ; embryo basal.

The genus *Ceratolobus* is mainly characterized by the very peculiar structure of the spadices which have the panicle (♂ and ♀) enclosed in only one spathe never opening completely. Apparently fertilisation happens inside the spathe, through a slit along the margins of the beak, by the agency of some insects, as the female flowers never remain exposed or even visible outside, not only during the anthesis, but also after they have been fertilized, owing to the main axis not lengthening out ; the fruits also remain enclosed in the spathes to the complete destruction of these latter. In other respects the genus *Ceratolobus* is closely related to *Daemonorops*, and is capable of being separated into two groups. One group contains the typical species (*Euceratolobus*), having leaves with rhomboidal or oblong-cuneate, radiately veined leaflets, lobulate-premorse in their upper margin and on the whole similar to those of several species of *Korthalsia*, from which the sterile plants of some species, especially when young, are distinguishable only with difficulty, so much so that on account of this great similarity it occurred to Blume to describe a *Ceratolobus* (*C. rostratus* Becc.) as a species of *Korthalsia* (*K. rostrata* Bl.). Nevertheless a *Korthalsia* is always recognizable by its leaf-sheaths prolonged above their mouths into a distinct ocrea, whereas in *Ceratolobus* the sheaths terminate with a membranous deciduous rim and appear exactly truncate. Moreover, all species of *Korthalsia* have the leaflets provided with a special small stalk or "ansa", which is always absent in *Ceratolobus*, the leaflets in the latter being attached directly to the rhachis, through an acute basis. As in *Korthalsia*, only the adult plants of *Ceratolobus* have cirriferous leaves.

The stems of *Ceratolobus* as well as of *Korthalsia* are very slender in young plants, but apparently gradually thicken with age, attaining their greatest diameter at their upper ends at the time of flowering.

The other group (*Cryptocladus*) containing only the polymorphic *C. laevigatus* is characterized by its leaves having linear or linear-lanceolate, unicostate, acuminate leaflets. Furthermore the spathes although having exactly the same structure as those of the other group, and their natural opening being only a slit at the sides of the beak, easily split longitudinally along the sides. *Cryptocladus* differs from *Daemonorops* only in having the spadix enclosed in a single subindehiscent spathe.

Geographical distribution.—The genus *Ceratolobus* is limited to the Malay Peninsula, Sumatra, Java and Borneo. Only six species are known, those of the *Euceratolobus* section being all localized species : *C. glaucescens* in Java, *C. concolor* in Sumatra, *C. discolor* and *C. rostratus* in Borneo and *C. Kingianus* in the Malay Peninsula. On the contray, *C.* (*Cryptocladus*) *laevigatus* is a rather widely dispersed plant, although presenting several apparently local forms, in the Malay Peninsula, Sumatra and Borneo.

CERATOLOBUS.

Key to the species.

A. Euceratolobus.—Leaves with rhomboidal or cuneately oblong, radiately veined leaflets.

I. Spadices provided with a long pedicellar part.

Leaf-sheaths armed with long spines. Leaflets mealy-glaucous underneath.

1. C. glaucescens Bl.—Java.

Leaf-sheaths covered with minute tubercled setae. Leaflets almost equally green on both surfaces.

2. C. concolor Bl.—Sumatra.

II. Spadices sessile.

Leaf-sheaths covered with minute seriate spiculae. Leaflets conspicuously discolorous, rhomboidal, the basal and apical ones smaller than the intermediate ; spathe very large, thinly fugaciously rusty-furfuraceous. The largest species of the genus.

3. C. discolor Becc.—Borneo.

Leaf-sheaths covered with minute seriate spiculæ. Leaflets slightly paler or subglaucescent underneath than above, the basal being the largest. Spathe fugaciously mealy-white. Neuter flowers similar to the males. Smaller plant than *C. discolor.*

4. C. Kingianus Becc.—Malay Peninsula.

Leaf-sheaths covered with minute seriate spiculæ. Leaflets mealy underneath, the lowest smaller than the intermediate. Spathe fugaciously rusty-furfuraceous. Neuter flowers similar to the female ones. A slender plant.

5. C. rostratus Becc.—Borneo.

B. Cryptocladus—Leaves linear or narrowly lanceolate, unicostate, acuminate.

6. C. laevigatus Becc.

α. Leaflets few in fascicles, relatively broad.

Forma typica—Malay Peninsula.

β. Leaflets not many, subequidistant.

var. **regularis**—Malay Peninsula.

γ. Fruit larger.

var. **maior**—Malay Peninsula.

δ.—Leaflets very narrow.

VAR. **angustifolius**—Malay Peninsula.

ε.—Leaflets numerous 12—13 on each side of the rhachis.

VAR. **subangulatus**—Sumatra.

ξ.—Stem more robust than in type; leaf-sheaths powerfully armed.

VAR. **borneensis**—Borneo, Sarawak.

η.—Leaves elongate, leaflets 15—17 on each side of the rhachis, exactly opposite and horizontal.

VAR. **divaricatus**—Dutch Borneo.

DESCRIPTION OF PLATE I. A.

Fig. 1—4. *Ceratolobus glaucescens* Bl.—Fig. 1. Extremity of a branchlet from a female spadix; *a*, female flower; *b*, neuter flower; *c*, spathel; *d*, involucrophorum; *e*, involucre.—Fig. 2. Extremity of a branchelet from a male spadix; *c*, spathel; *d*, involucre.—Fig. 3. Partial section of a female flower showing the pistil entire; *d*, involucrophorum; *e*, involucre; *f*, calyx; *g*, staminodes.—Fig. 4. Partial section of a male flower showing the entire androecium (Fig. 1—4 enlarged 10 diam.).

Fig. 5—7. *Ceratolobus concolor* Bl.—Fig. 5. Seed from the chalazal fovea side.—Fig. 6. The same from the antiraphal side.—Fig. 7. Longitudinal section of the same (all enlarged 2 diam.).

DESCRIPTION OF SPECIES.

1. CERATOLOBUS GLAUCESCENS Bl. in Roem. et Sch. Syst. Veget., vii. 1334; Rumphia, ii, 165, t. 129 and 137. F. A.; Pl. Jungh, i, 101; Mart, Hist. Nat. Palm., iii, 196, t. 115, I.; Miq. Fl. Ind. Bat. iii, 73.

DESCRIPTION.—Slender and high scandent. *Sheathed stem* about 15 mm. in diameter. *Leaf-sheaths* cylindrical, not or very slightly gibbous above, densely armed with very unequal, scattered, rigid, slender, grayish, 2—3 cm. long, needle-like spreading or deflexed spines, intermingled with others very small and only a few millimeters long; the mouth of the sheaths is obliquely truncate (not produced into an ocrea), armed with ascendent spines similar to those of the body of the sheaths and with narrow membranous borders produced into an axillary short triangular acute ligula. *Leaves* about 75 cm. long in the pinniferous part; the petiole 5—15 or more cm. long, 7—8 mm. thick, spinescent, subterete, flattish above; the rhachis also subterete, more or less prickly, but especially armed along the dorsum with some slender, straight, deflexed, 2—3 cm. long spines, at first ternate, becoming solitary and smaller above; the cirrus slender, regularly armed with small very sharp ternate claws. *Leaflets* not many, 8—10 on each side of the rhachis, alternate or subopposite, papyraceous, light green above, powdery-glaucous beneath, rhomboidal, oblong-rhomboidal or rhomboidal-cuneate, narrowing from the middle or from a little above to an acute, not ansate, base; the upper margins subduplicately lobulate-crenate; the lobules very minutely setose aristate, the apex caudiculate, or prolonged into a triangular elongate and at the sides spinulous ciliate point; leaflets radiately plicate along several (12—15) very slender primary nerves, the nerve of the centre being slightly stronger than the others; the intermediate leaflets are 18—22 cm. long, 7—9 cm. wide, those of both ends narrower but not shorter. *Male* and *female spadix* similar, attached to the leaf-sheaths by a very slender, recurved, filiform, spinous pedicelliform part, frequently 10—15 cm. long, but at times shorter, covered with very slender, some long and some short, spines, the longest 8—10 mm. long. The spathe is lanceolate-elliptical or broadly fusiform, strongly flattened with very sharp edges, 10—25 cm. long, 2—4 cm. broad, equally narrowing to both ends, very suddenly contracted above into a narrow linear beak, 1—2 cm. long, thinly papyraceous dry and brittle, of a cinnamon-brown colour, at first powdery, later glabrous; the included flattened panicle is cupressiform, has a very slender sinuous axis and is divided into several gradually diminishing slender floriferous branchlets; the bracts at each branching are small and trigonous with a subulate point and an amplectent base. The spadices bearing only male flowers (not seen by me) according to Martius are only slightly less branched (or more? Becc.) than the female-males or polygamous, and their flowers are only slightly larger than the male or neuter ones of the latter. In the female spadices the branchlets bear the flowers in pairs at each flexure, every female flower being accompanied by a male (or neuter) flower; they are suffulted by two short embracing spathels (produced at one side into a triangular acute point) and correspond to the involucrophorum and involucre of *Daemonorops*. *Female flowers* ovoid, or elongate-ovoid, acute or acuminate, 4—5 mm. long; the calyx cyathiform, truncate, 3-toothed, strongly striately veined, longer

than the spathels; the corolla is nearly 3 times as long as the calyx, is parted below the middle into 3 triangular acute or acuminate segments, and is entire and ventricose in its lower part; the stamens have the filaments connate with the undivided part of the corolla and are provided with a short free portion at its throat and have rather well formed, but sterile, narrowly sagittate anthers; ovary globose, covered with large, suborbicular, fimbriate scales; style almost none; stigmas elongate trigonous, subulate thickish, strongly lamellose on inner side, spreading and recurved during the anthesis. *Neuter flowers* inserted through a very short pedicel laterally to the female, inside the lowest (the involucrophorum) of the two spathels; they are lanceolate, more or less trigonous, acute, 5 mm. long, 1—5 mm. wide; the calyx short with 3 acute teeth; the corolla much longer than the calyx; petals lanceolate, acute; stamens have the filaments adnate to the base of the petals and with a short free part; anthers linear sagittate, well formed but apparently sterile; rudiments of the ovary very minute, papilliform. The mature *fruit* unknown.

HABITAT.—Java: in Bantam on the mountains on the limestone rocks near Kuripan (Res. of Buitenzorg) and in the forests in Wijnkoops Baai or Palabuan Ratu (*Miquel, Blume*). From this last locality I have a specimen collected by the late *Dr. Boerlage.*

OBSERVATIONS.—It is characterized by its slender stem covered with sheaths thickly armed with slender unequal spines; by the cuneately rhomboidal leaflets powdery or mealy-glaucous beneath and by the reflexed spadices borne on very slender spinous elongate pedicels.

PLATE 1.—Ceratolobus glaucescens *Bl.* Portion of the spadix-bearing stem; one leaf wanting only its basal part and a separate spadix with half the spathe removed, to show the female panicle; from a plant cultivated at Buitenzorg. Upper part of a leaf-sheath with a spadix "in situ:" from a specimen collected by Dr. Boerlage at Wijnkoops Baai.

2. CERATOLOBUS CONCOLOR Bl. Rumphia, ii, 165, t. 120 f. 1; Miq. Fl. Ind. Bat. iii, 74.

DESCRIPTION.—Very slender. *Sheathed stem* 6—9 mm. in diameter. *Leaf-sheaths* distinctly puckered below the petiole, rendered more or less scabrid by very minute tubercled spinules; the mouth truncate, with a narrow membranous border, produced into an axillary, short, triangular, acute glabrous or slightly hairy ligula. *Leaves* 40—60 cm. long in the pinniferous part; the petiole short, 4—5 cm. long or at times more, subterete, smooth or scabrid, unarmed or provided with a few straggling straight spines on the dorsum; rhachis obsoletely trigonous, scantily armed on the dorsum with distant solitary claws; the cirrus very slender, very minutely and regularly clawed. *Leaflets* few, 4—5 on each side of the rhachis, all about the same size, 12—15 cm. long, 3—5 cm. wide, alternate or subopposite, papyraceous, light-green and dull on both surfaces, elongate-rhomboidal or cuneately rhomboidal, narrowing from, or from a little above, the middle to an acute non-ansate base; the upper margins irregularly undulate-crenate, the lobules very minutely setose-aristate or muticous; the apex caudiculate or prolonged into a

triangular elongate point which at the sides is inconspicuously spinulous-ciliate; they are radiately plicate along 9—11 very slender primary nerves, the nerve of the centre being slightly stronger than the others. *Spadices* long pedunculate. *Fruit* subglobular. *Seed* ovate, 15 mm. long, 11 mm. broad, rounded at both ends, the lower slightly broader than the upper, having a deep elongate chalazal fovea on the raphal side, and the surface coarsely pitted, the hollows leading to rather deep cylindrical intrusions of the integument, so as to render the albumen ruminated. Embryo exactly basal.

Habitat.—On the east side of Sumatra in the Province of Palembang, and on the west in the Province of Padang, along the river Singalang (*Bl. Miq.*), where I collected in August 1878 sterile specimens at Ajer Mantjor, about 360 m. above the sea level. Fertile specimens have been gathered quite recently (1915) by *Grashoff* (No. 189 in Herb. Bogor. and Becc.) at Lamatang Ulu in Palembang.

Observations.—It has the general aspect of *C. glaucescens*, from which it differs not only in being a more slender plant, but also in its leaf-sheaths being non-spinous at the mouth and not covered all over with long spines, but only with very small minute tubercled spinules or setae; but especially it differs by the leaflets not being mealy-glaucous beneath, but almost equally green on both surfaces. My Sumatran specimens belong to a not yet flowering plant; the sheathed stem is 5 mm. in diam., the naked canes 3 mm.; otherwise they are identical with Blume's type, from which the description of the seed is drawn up.

The specimens collected by Grashoff (No. 189) bear spadices with very young fruits, have the leaf-sheaths very minutely and densely scabrid; the bases of the petioles are also scabrid. The spadices have a very slender and long peduncular part (13—15 cm. long); the spathe is narrowly fusiform, long beaked (13—16 cm. long, 15 cm. wide), very gradually narrows towards both ends, and has acute but not winged edges.

Plate 2.—Ceratolobus concolor *Bl.* Portion of the sheathed stem with an entire leaf; and portion of the stem bearing a spadix with very young fruits. From Grashoff's No. 189 in Herb. Beccari.

3. Ceratolobus discolor Becc. Malesia, iii, 63.

Description.—Of moderate or rather large size. The upper part of the *sheathed stem* in adult fertile plants is 2—3 cm. in diam., of the younger plants only 8—10 mm. *Leaf-sheaths* gibbous above, striate pluricostulate, thinly and fugaciously rusty-furfuraceous, covered with small, unequal, erect, brown, glossy spiculae, 4—5 mm. long at most, often approximate by their bases and irregularly seriate; beside this kind of spicule, the leaf-sheaths are occasionally provided with some very thinly laminar, flaccid lanceolate spines, 2—2·5 cm. long and 3—4 mm. broad at their bases; the mouth is obliquely truncate, unarmed, bordered by a narrow membranous rim, which is prolonged into an axillary perishable ligula. *Leaves* rather large, about 80 cm. long in the pinniferous part; the petiole 20—30 cm. long, subterete or slightly flattened especially at its base, 6—10 mm. thick, more or less armed with straight, spreading, scattered or shortly seriate spines; rhachis subterete or sub-trigonous being obtusely bifaced above and rounded below, more or less armed on the dorsum, especially in

its lower portion, with ternate robust claws; petiole and rhachis clothed with a cottony, fluffy, detachable indumentum; cirrus up to 1·50 m. long, irregularly and powerfully clawed. *Leaflets* 5—7 on each side of the rhachis, alternate or subopposite, rigid-papyraceous, rhomboidal or broadly cuneately rhomboidal, radiately-plicate along several very slender primary nerves, that of the centre being slightly the stronger, conspicuously discolorous, green above, mealy white beneath; the base acute and non-ansate; the upper margins irregularly subduplicately lobulate and erosely toothed, the lobules more or less minutely setose-aristate; the apex acute or produced into a triangular acuminate point; the intermediate leaflets of the quite adult plant are 20—40 cm. long, and 10—18 cm. wide, those of both ends or of younger plants smaller. *Male spadix* . . . . *Female spadix* sessile, erect; the spathe very large, 55 cm. long, 10 cm. wide (in one specimen), oblanceolate-spathulate or subelliptical, strongly flattened with very sharp edges, narrowing below to a rather acute base and suddenly contracted above to a stout beak, 5—6 cm. long, the beak only split in two halves during the anthesis; the margins near the base have a few reversed spinescent teeth, otherwise they are almost smooth or obsoletely minutely toothed; the body is thinly coriaceous, of a cinnamon brown colour, darker inside, partially covered outside with a detachable thin tobacco coloured scurf, which leaves the denuded surface very minutely pitted, when observed with a lens. The *female panicle* during the anthesis is strict, elongate and narrow, about 50 cm. long, twice branched; its main axis is slightly flattened, 6—7 mm. broad, alternately bearing several gradually smaller fastigiate angular branches, which are divided again into several gradually smaller flower-bearing branchlets; the spathes at the base of each primary branch are membranous, have a short infundibular part, and are produced at one side into a narrow, long, subulate point; the spathes of the secondary branches are smaller and have a shorter point; the flower-bearing branchlets have alternate, shortly infundibuliform, truncate spathels, produced at one side into an acute point; at each flexure of the branchlets are two flowers, one of which is a female and the other a neuter, both suffulted by a shallowly cupular 3-toothed involucrophorum and an involucre; the areola of the neuter flower is punctiform. *Female flowers* have a broad roundish base and a trigonous acute upper part, are 6 mm. long and 4 mm. broad; the calyx is membranous, very short, shallowly cupular, 3-toothed; the corolla is considerably longer than the calyx, parted to a little above the base into 3 deltoid acute segments, its undivided part being very short; filaments adnate in their lower part to the base of the corolla, triangular-subulate in their free part, and bearing linear-sagittate sterile anthers; ovary globose, covered with large suborbicular fimbriate scales; stigmas sessile, elongate, thick spreading and recurved. *Neuter flowers* very similar to the female ones, about as long but narrower; the corolla has a short undivided part, the segments are triangular acuminate; the filaments are elongate and subulate; the sterile anthers are very narrowly sagittate and inserted at the middle of the dorsum; no rudiments of an ovary. The spadix loaded with mature fruits forms a large panicle recurved by its weight, its spathe being destroyed. *Fruit* nearly spherical, 15—17 mm. in diam., the apex very shortly conically beaked, surmounted by the very small remains of the stigmas; scales in 12 longitudinal series, rhomboidal, broader than long, obtuse at apex, neatly grooved along the centre, of a uniform chestnut brown colour with a narrow darker marginant line, the margins obsoletely and very minutely

erose. *Fruiting perianth* obconical, the fruit on that account looking as if narrowing to the base, and attaining 2 cm. in length. *Seed* globular, 1 cm. in diameter; when divested of the dry adherent crustaceous, apparently once fleshy integument, it has a pitted surface, and an elliptical deep chalazal fovea on the raphal side; albumen bony not deeply ruminated. Embryo basal.

Habitat.—Borneo. This fine and distinct palm was first described from sterile specimens collected by me in the forests near Kuching in Sarawak. It has been later found again in flower by *J. Hewitt* (Kew Herb.), along the Barram River in the N.-W. of the Island, and in fruit by *D. Hallier* at Amai Ambit in Dutch Borneo (No. 3387 in Herb. Hort. Bot. Bogor.).

Observations.—The species is characterized by its large size; by its leaf-sheaths being covered with minute seriate spiculae; by its conspicuously discolored rhomboidal leaflets, those of both ends smaller than the intermediate ones; by its spadix sessile erect, having a very large spathe; by its ovoid female flowers having the corolla divided past the middle into deltoid segments; by its neuter flowers being very similar to and only slightly smaller than the female ones; by its globose, very briefly apiculate fruit suffulted by an obconic subpedicelliform fruiting perianth.

The sterile specimens from Sarawak are very variable as to the size of the leaf-sheaths (from 7 to 17 mm. in diam.) at times almost unarmed, the spinules being apparently deciduous; the leaflets vary from 18 to 30 cm. in length, and 6 to 14 cm. in diameter. In Hewitt's flowering specimen the sheaths are 2 cm. in diam., and are provided, in addition to the small spiculae, with some laminar spines; the largest leaflets are 30 cm. long and 10 to 12 cm. broad. In the fruiting specimen from Amai-Ambit some of the sheaths are 3 cm. in diameter and covered with minute subseriate spines; the largest leaflets are 40 cm. long and 17·5 cm. broad.

Plate 3.—Ceratolobus discolor *Becc.* Upper portion of a stem bearing the base of a spathe attached laterally to the upper part of a leaf-sheath; the end of the spathe represented in the preceding figure; intermediate portions of a leaf; one branch of the female spadix. From Hewitt's specimen in the Herbarium at Kew.

Plate 4.—Ceratolobus discolor *Becc.* Portion of the sheathed stem bearing the lowest branches of the fruiting spadix (the upper and terminal part of the spadix is wanting). Intermediate portion of a leaf. From Hallier's specimen in the Herbarium at Buitenzorg.

4. Ceratolobus Kingianus Becc. in Hook. f. Fl. Brit. Ind. vi, 477; Ridley, Mat. Fl. Mal. Penins. ii, 187.

Description.—Of middling size, 6—8 m. long. The upper part of the *sheathed stem*, in adult fertile plants, 2—3 cm. in diameter. *Leaf-sheaths* gibbous above, when young thinly fugaciously mealy-furfuraceous and very densely clothed up to the base of the petiole with very minute, rigid, erect, brown hairs, disposed in very approximate interrupted irregular series, later deciduous and leaving the surface of the sheaths scabrid by their permanent bases, arranged in slightly raised finely imbricate ridges; occasionally a few larger rudimentary spines appear scattered among the hairs; the

mouth is obliquely truncate, unarmed, bordered by a narrow membranous brittle rim, prolonged into an axillary perishable ligula. *Leaves* rather large, but the pinniferous part short (40—55 cm. in length); the petiole 12—20 cm. long, 6—8 mm. broad, very slightly flattened with round margins, beset all round with short prickles; rhachis subterete or very obsoletely-trigonous, armed with ternate claws on the dorsum; petiole and rhachis apparently very fugaciously mealy, later glabrous; cirrus slender, armed at regular intervals with ternate claws. *Leaflets* very few, 3—5 on each side of the rhachis, alternate, rigid-papyraceous, cuneately rhomboidal, radiately plicate-pluricostulate, green above, paler or glaucescent beneath; the base acute, non-ansate; the upper margins irregularly subduplicately lobulate and erosely toothed, the lobules occasionally setose-aristate; the apex triangular or slightly produced, acute; the lowest leaflets are the largest, 20—30 cm. long, 10—13 cm. broad, those above gradually smaller. *Spadices* sessile erect, male and female externally exactly alike; spathe lanceolate-elliptical 20—28 cm. long, 4—7 cm. broad, strongly flattened, equally narrowing to both ends with a beaked triangular apex; the margins at the base are minutely toothed, elsewhere smooth and very sharp; the body is rigid papyraceous, cinnamon-brown at first, thinly and very fugaciously mealy, later glabrous. *Male panicle* well furnished with flowers and completely filling the cavity of the spathe; the main axis terete, strongly sinuous, 3 times divided; the secondary branches also terete, slender and sinuous; the divisions of third degree are short flower-bearing branchlets, and carry 3—6 alternate flowers; the lowest internal (secondary) spathe is lanceolate-acuminate, considerably larger than the following; outside of this is a lateral primary branch; the other secondary spathes of the main axis are tubular, closely sheathing, obliquely truncate at the mouth and produced at one side into a subulate point; the spathels (spathes of the flower-bearing branchlets) are shortly infundibuliform, produced at one side into a triangular acute spreading point, which suffults a sessile male flower; the latter provided with a small very shallowly cupular, trigonous, 3-toothed involucre. *Male flowers* regularly oblong, blunt, trigonous, 5 mm. long, 2 mm. broad; the calyx shortly cupular, trigonous three-toothed; the corolla several times longer than the calyx, divided not quite to the base into 3 coriaceous, linear petals, callous (nectariferous?) internally in their lowest undivided part, striate, and very finely shagreened externally, when seen through a strong lens; stamens having very slender subulate filaments, inflexed at the apex, inserted near the base of the petals, and alternating with their callosities; anthers linear, very narrow, bluntish, attached at the middle of the dorsum; the cells parallel, dehiscing laterally; rudimentary ovary extremely small, papilliform. The *female panicle* is strict, always even after the anthesis within its spathe, twice branched; the main axis obtusely angular, bearing alternately not many gradually smaller fastigiate branches, which are divided again into few flower-bearing branchlets, subunilaterally bearing 2—3 female flowers only, each of which is accompanied by a neuter one; spathes of the branches and spathels as in the male spadix; both involucrophorum and involucre shallowly-cupular, 3-toothed; the areola of the neuter flower punctiform. *Female flowers* subglobose, 3 mm. in diameter at the base, and trigonous-pyramidate above; the calyx membranous, very short, shallowly-cupular, 3-toothed; the corolla considerably longer than the calyx, parted a little above the base into 3 deltoid acute segments, its undivided part being very short; filaments connate below with the

base of the corolla, triangular subulate in their free part, and having sagittate sterile anthers; ovary globose, covered with large suborbicular fimbriate scales; stigmas sessile, elongate, thick, spreading and recurved. *Neuter flowers* differing considerably from the female, and very much like the male ones, being only a little larger than these (6 mm. long) and having sterile, very narrowly sagittate anthers. *Fruiting* perianth explanate. *Fruit*, when thoroughly mature, globose, 15 mm. in diameter, the apex very briefly conically beaked and surmounted by the very small remains of the stigmas; scales in 12 longitudinal series, rhomboidal, broader than long with obtuse apex, strongly convex, narrowly grooved along the centre; of a uniform dark reddish brown colour when dry, orange red when fresh with the margins smooth. *Seed* globular, 1 cm. in diameter, covered with a thin adherent integument, minutely wrinkled when dry; the chalazal fovea deep, sulciform, lateral; albumen long, not deeply ruminate. Embryo basal.

Habitat.—The Malay Peninsula. In dense hilly jungle at Larut in Perak (*King's collector* Nos. 5589 and 2856 in Herb. Calc.—female plant and 2547—male plant).—In the same district coll. by *L. Wray Jun.* (Herb. Mus. Perak No. 2869.)

Observations.—It is a smaller plant than *C. discolor*. It is characterized by the sheaths covered with minute seriate rigid spinuliform hairs, leaving after their fall numerous approximate interrupted muricate ridges; by the pinniferous part having few leaflets, subglaucescent, but not mealy beneath, the lowest being the largest; by the spathe moderately large, at first mealy pulverulent, later glabrous, and with trigonous shortly produced apex; by the neuter flowers not resembling the female but being very similar to the male ones; by the globular fruit borne on a quite explanate perianth.

Plate 5.—Ceratolobus Kingianus *Becc.* Leaf-sheath with a male spadix (a portion of the wall of the spathe removed to show the male panicle), and an entire leaf. From No. 5589 in the Calcutta Herbarium.

Plate 6.—Leaf-sheath with a female spadix (half the wall of the spathe removed to show the female panicle with young fruits inside); from No. 2856 Herb. Calc. An entire female spadix; from No. 5589 Herb. Calc. One mature fruit and one seed seen from the side of the chalazal fovea; from No. 5589 in the Calcutta Herbarium.

5. Ceratolobus rostratus Becc.

> *Korthalsia rostrata* Bl. Rumphia, ii, 168; Mart. Hist. Nat. Palm., iii, 211; Miq. Fl. Ind. Bat., iii, 75, and De Palm. Arc. Ind. 26; Walp., Ann., iii, 492; Becc. Malesia, ii, 76.
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> *Ceratolobus Hallierianus* Becc. MSS. name in Herb. Hort. Bot. Bogor.; Heyne, Nuttige Pl. Neder l. Ind. (1913), 93.

Description.—Slender or of middling size. The upper part of the *sheathed stem* in adult fertile plants 15—20 mm. in diameter. *Leaf-sheaths* gibbous above, more or less distinctly boldly striate or sub-costulate longitudinally, covered with a tobacco-coloured scurf and armed with very unequal spines, some scattered or at times

slightly confluent by their bases, thinly laminar, narrowly lanceolate, reddish brown, 10—15 mm. long, often obliquely inserted, others, many more, very small and bristle-like, approximate by their bases, brittle and deciduous, leaving after their fall small raised finely muricate interrupted ridges; the mouth is obliquely truncate, unarmed, bordered by a narrow membranous brittle rim, and prolonged into an axillary perishable ligula. *Leaves* rather large, pinniferous part about 80 cm. in length; the petiole 18 to 20 cm. long, 6—7 mm. broad, very slightly flattened with round margins and beset all round with unequal, at times shortly seriate prickles; rhachis subterete or very obsoletely trigonous, armed on the dorsum with ternate, and higher up and especially on the cirrus with 5-nate or half-whorled claws; petiole and rhachis covered partially with tobacco-coloured detachable scurf. *Leaflets* 6—7 on each side of the rhachis, alternate or subopposite, rigid-papyraceous, cuneately rhomboidal, radiately plicate-pluricostulate, green above, ashy gray or whitish beneath; the base acute, non-ansate; the upper margins irregularly lobulate undulate, erosely toothed and deciduously ciliolate; the apex triangular-acuminate; the intermediate leaflets are the largest, 20—27 cm. long, 8—9 cm. broad; the lowest pair smaller and narrower. *Spadices* sessile, erect; spathe lanceolate-elliptical, 28 cm. long, 5 cm. wide (in one specimen), strongly flattened, narrowing equally to both ends; the apex triangular and prolonged into a narrow linear beak, the margins very sharp, entire, the body rigid-papyraceous, cinnamon brown, covered partially outside with a detachable thin tobacco-coloured scurf. *Male panicle* much divided into short, very slender, floriferous branchlets. *Male flowers* very small, 2·5 mm. long, trigonous-ovoid, obtuse; calyx very small, shallow trigonous. *Female panicle* strict; the main axis slender, sinuous, bearing gradually smaller fastigiate branches, each of which is very slightly divided into small floriferous branchlets bearing only 2—3 female flowers (each as usual accompanied by a neuter); spathes with a short tubular part produced at one side into a long subulate point; the spathels very shortly infundibular and produced at one side into a triangular spreading point; involucrophorum and involucre shallowly cupular, 3-toothed. *Female flowers* 5 mm. long, a little over 3 mm. in diameter, ovoid, trigonous-pyramidate in their upper part; the calyx very short, shallowly cupular, 3-toothed; the corolla considerably longer than the calyx, parted to a little above the base into 3 deltoid, acute segments, its undivided part being very short; filaments connate below with the base of the corolla, triangular in their free part and bearing small sagittate rudimentary anthers; ovary globose, covered with large suborbicular fimbriate scales; stigmas sessile elongate, thick, spreading and recurved. *Neuter flowers* very similar to female ones, only a little more slender, more acuminate and a trifle longer, having, like those, the lower part of the corolla urceolate, but wanting the ovary, and having the cavity lined with the bases of the filaments of the stamens; the free part of the filaments elongate and filiform; the sterile anthers are slender and sagittate. The perianth is apparently explanate under the fruit; this was seen by me only when very young.

HABITAT.—Dutch South Borneo. I have flowering specimens from Bandjermasin (No. 17 in Herb. Hort. Bot. Bogor. and Beccari) and others sterile from the same place collected by *Heyne* (19 bis and 30 in Herb. Hort. Bot. Bogor.). Sterile specimens, which exactly correspond to *K. rigida* Bl. were also collected by *Hallir*

in 1893-94 on the Sungei Kenepai in Dutch Borneo (No. 2088 in Herb. Bogor.). The specimens upon which was established *K. rigida* Bl. were collected on the Duson.

Observations.—It is a very near ally of *C. Kingianus*, which it greatly resembles in general habit and in the spadices; it differs however from this latter in the leaves having more leaflets, of which the lowest pair are smaller than the intermediate; it differs also in the spathe being covered more or less with tobacco-coloured scurf, and in the neuter flowers being very similar to the fertile ones.

The young plant of *C. rostratus* collected by Hallier (No. 2088) exactly corresponds to *K. rostrata* Bl., of which I have seen a portion of the type specimen preserved in the Leyden Herbarium. In this the leaflets have no ansa, and this alone is a character sufficient for retaining *K. rostrata* Bl. as a *Ceratolobus*.

In Hallier's specimen from Amai Ambit, which evidently was detached from a young plant, the sheathed stem is 6—7 mm. in diameter, the leaves have a very short petiole, are about 40 cm. long in the pinniferous part, and have 5—6 leaflets on each side of the rhachis; the leaflets are elongate, cuneately rhomboidal, conspicuously caudiculate-rostrate and whitish beneath; the intermediate and largest leaflets are 13—15 cm. long, 4—5 cm. broad, the lowest being considerably smaller.

One of Heyne's specimens (19 bis) also taken from a young plant is very similar to that of Hallier; its sheathed stem is 8 mm. in diameter; the petioles are 5—7 cm. long and the leaflets as in Hallier's specimen; but another specimen of the same collector (taken however from a more adult plant) has the sheathed stem 15 mm. in diameter, the petioles are 12—15 cm. long, and the leaflets 20—23 cm. in length; this specimen evidently forms a connecting link to the adult plant described above; the apex of the leaflets is very variable, at times being long beaked and at times almost blunt as in Heyne's specimen No. 30 from Bandjermasin: this specimen is also remarkable for its slender stem, its sheaths being only 12 mm. in diameter and encircled by very few laminar spines, whereas in the other also of Heyne (No. 19) mentioned above, the sheaths are 15 mm. in diameter, the laminar spines are numerous, often confluent by their bases, and the muricate ridges are few and much interrupted.

The male flowers have been described from a plant that has flowered recently at Buitenzorg (Herb. No. 309).

Plate 7.—Ceratolobus rostratus *Becc.* Portion of a leaf-sheath with a spadix and one leaf, from Bandjermasin (No. 17 in Herb. Bogor.).

Plate 8.—Ceratolobus rostratus *Becc.* Terminal part of a young plant corresponding to *Korthalsia rostrata* Bl., from Sungei Kenepai (Hallier No. 2088 in Herb. Bogor.).

6. Ceratolobus laevigatus Becc. in Hook. f. Fl. Brit. Ind. vi, 477; Ridley, Mat. Fl. Mal. Penins. ii, 187; Heyne, Nuttige Pl. Nederl. Ind. (1913), 9·4.

Calamus laevigatus Mart. Hist. Nat. Palm iii, 339; Walp. Ann. iii, 489 and v, 831; Miq. Fl. Ind. Bat. iii. 129.

Calami sp. Griff. in Calc. Journ. Nat. Hist. v, 72, and Palms Brit. Ind. 72 (last 5 lines.)

Ceratolobus laevigatus var. *angustifolia* Becc. in Hook. f. l. c.

Ceratolobus subangulatus Becc. in Ann. Roy. Bot. Gard. Calc., XI (Suppl. III.

Calamus subangulatus Miq. Prodr. Fl. Sum. 256, 594.

Description.—Slender and apparently not very high scandent (2·5—3 m. high—Ridley). *Sheathed stem* 8—14 mm. in diameter. *Leaf-sheaths* strongly gibbous above, covered with a tobacco-coloured fugacious scurf, brown when dry, often boldly, but at times faintly, striate-pluricostulate, armed with scattered, occasionally subconfluent, flattened, broad-based, spreading, deflexed, pale spines, 5—10 mm. long; the mouth obliquely truncate, unarmed, bordered by a narrow membranous brittle rim, prolonged into an axillary perishable ligula. *Leaves* small, the pinniferous part usually 40—45 cm., up to 60 cm., long but at times only 25—30 cm.; the petiole almost wanting, the lowest leaflets being inserted very near the mouth of the sheaths; rhachis trigonous, armed along the dorsum, at times powerfully, with solitary or ternate claws; the cirrus slender and elongate, armed with very approximate halfwhorls of very sharp claws. *Leaflets* usually not very numerous, 10—12 on each side of the rhachis, rarely so many as 15—17, variously set, frequently in distant opposite groups of 2—3 on each side of the rhachis, or else, and this frequently, subequidistant; some of the leaflets, specially the intermediate, are exactly opposite and divaricate, those of one side forming with those of the other side one horizontal line; the leaflets of the apex are ascendent, and the lower deflexed; they are papyraceous, green on both surfaces, lanceolate, oblanceolate or linear-lanceolate, at times very elongate and narrow, tapering below to an acute base, where they are furnished with a more or less distinct axillary callus; are acuminate and suddenly contracted above or are, at times, gradually lengthened out into a very narrowly linear or filiform tip, 15—20 mm. long, bristly penicillate at its apex; their mid-costa is slender, raised on the upper surface, smooth, or at times very sparingly setulose only above or also on both surfaces; secondary nerves 2 on each side of the mid-costa, very slender; transverse veinlets faint; the lower margin is often marked on the upper surface with a broad polished band; the margins are very remotely ciliate-spinulous; the intermediate leaflets are the largest; the proportion of their length to their breadth is very variable, some being 10—15 cm. long and 15—20 mm. broad, and others 25 cm. long and only 12—13 mm. broad, the lowest leaflets are at times very narrow and have a more distinct basal callosity than the upper. *Spadices* erect, male and female externally alike, borne on a short pedicellar part (1—2 cm. long), flattened and acutely two-edged. *Spathe* narrowly lanceolate-elliptical or flattened-fusiform, 12—30 cm. long, 2—3 cm. broad, gradually narrowing below to an acute base, and above to a long and narrow beak, dry, papyraceous, cinnamon-brown, finely and fugaciously rusty-furfuraceous, the edges very sharp. The normal opening of the spathe is along the margins of the beak, but frequently its walls are split longitudinally, these being very thin and brittle. *Male panicle* well furnished with flowers, completely filling the cavity of the spathe, much branched, its main axis strongly sinuous; the floriferous branchlets are divisions of third degree, very short, and

carry 2—3 flowers only; spathels shortly infundibuliform, produced at one side into a triangular acute point suffulting a sessile male flower, of which the involucre is small, very shallowly cupular, trigonous, and 3-toothed. *Male flowers* regular, ovoid-ventricose, trigonous, and obtuse; 4 mm. long, 3 mm. broad; the calyx membranous, shallow, broadly 3-lobed; the corolla much longer than the calyx, parted nearly to the base into 3 ovate-cymbiform bluntish coriaceous petals. Stamens . . . . (the several flowers examined had had all their stamens destroyed by an insect). *Female panicle* twice branched, its primary branches alternate, straight, terete, puberulous-furfuraceous and divided into few floriferous branchlets, each branchlet having 3—5 alternate flowers; spathels infundibuliform, truncate obliquely at the mouth, and produced at one side into a triangular acute point; involucrophorum cyathiform and frequently distinctly pedicellate, similar to the spathel; involucre slightly protruding beyond the involucrophorum, shortly cupular more or less distinctly 3-toothed; areola of the neuter flower distinct. *Female flowers* 6 mm. long, 4 mm. broad, ovoid, having the lower half slightly ventricose; the calyx membranous, very shallowly cupular, 3-toothed; the corolla coriaceous, parted down not farther than to the middle, into 3 thickish semiovate segments; filaments adnate below to the ventricose base of the corolla, triangular in the free-part; anthers sterile, linear-sagittate; ovary globular, clothed with large suborbicular fimbriate scales; style distinct, stout; stigmas thick, elongate, recurved. *Neuter flowers* very similar to the male ones (they had also had the stamens destroyed by an insect). *Fruit* subglobose-ovoid, or elliptical-ovoid, conically beaked. 16—20 mm. long (rarely more), 12—15 mm. in diameter, borne on the very shortly pedicelliform perianth; scales in 12 longitudinal series, dark or reddish-brown, rather dull, convex, narrowly grooved along the centre, bluntish, the margins very finely erose. *Seed* globular-ovoid, about 1 cm. in diameter; its surface obscurely pitted being covered by the thin adherent (perhaps once slightly fleshy) integument; chalaza fovea central, rather deep; albumen ruminate. Embryo basal.

HABITAT.—The Malay Peninsula, Singapore, Sumatra, and Borneo. It seems a rather common plant in the Malay Peninsula. At Malacca (*Griffith*—the type specimen in the Calcutta and Kew Herbaria); in the district of Perak (*Scortechini* Nos. 126. 123[b] in Herb. Becc.); at Larut (*King's collector* Nos. 5916, 8092, 7953, 1879); at Goping (*King's collector* No. 971) and Maxwells Hill (*Ridley* No. 3488 in Herb. Becc.); in Selangore at Sungei Buluh (*Ridley* No. 13448 in Herb. Kew) and Semangkok Pass (*Ridley* No. 12120 in Herb. Becc.); in Singapore (*Ridley* No. 10220 in Herb. Becc.); Dinding at Lamut (*Ridley* No. 3489 in Herb. Becc.). Ridley gives also the following localities (the specimens not seen by me)—Perak at Bujong Malacca (*Curtis, Ridley* No. 9812); Gunong Keledang (*Ridley* No. 9808); Kamuning (*Macchadò*); in Dinding at Lamut (*Ridley* Nos. 7907, 10270).

In Sumatra it was first collected by *Teijsmann* in the West at Priaman. (No. 2024 in Herb. Bogor.)—This is the type specimen of *C. subangulatus* Miq. I have found it again at Ajer Mantjor in the Prov. of Padang (*Becc.* P. S. No. 519).

In Borneo in Sarawak (*Merrill's Native collector* No. 1471 in Herb. Manila); in Dutch Borneo at Liang-gagan (*Hallier* No. 2758 in Herb. Bogor.); at Bandjermasin (No. 22 in Herb. Bogor.).

OBSERVATIONS.—A very variable plant, of which several sub-species could be distinguished, if any value could be attached to the size, shape, and arrangement of the leaflets on the rhachis; but no appreciable differences are offered by the spadices, flowers and fruit. We may recognize the following varieties:

VAR. α (FORMA TYPICA). With Griffith's type specimen of *C. laevigatus* agrees Ridley's No. 12120 and Scortechini's Nos. 123[b] and 126[b]. All these specimens have leaves with a short pinniferous part and lanceolate leaflets, relatively broad and short, 15—22 mm. broad, 10—20 cm. long, suddenly contracted at apex, and arranged into more or less distant opposite groups.

VAR. β REGULARIS. The leaflets are more elongate and narrower than in var. α and are almost regularly set, opposite-divaricate, those of one side forming a horizontal line with those of the opposite side. To this variety is referable Ridley's No. 3489 from Larut.

VAR. γ MAJOR. The fruit is larger than in any other variety, it is ovoid-elliptical; 25 mm. long, 18 mm. in diameter; the seed is ovoid, 14 mm. long, 10 mm. across. Ridley's No. 7953 from Larut belongs to this variety.

VAR. δ ANGUSTIFOLIUS. (*King's collector* No. 1879) from Larut on the hills is the type of *C. laevigatus* var. *angustifolius* Becc. in Hook. f. l. c. It differs from the type in its smaller dimensions and more slender stem; in the very narrow, very acuminate grouped leaflets, and apparently also in its more distinctly conically beaked fruits.

VAR. ε SUBANGULATUS. This is *Calamus subangulatus* Miq. It differs from the typical form in having the pinniferous part of the leaves more elongate, with 12—13 very elongate and narrow leaflets on each side on the rhachis, not grouped, but usually regularly opposite and divaricate exactly as in var. β, often bristly on the midcosta on both surfaces. It is the Sumatran form of *C. laevigatus*, and to it belong the specimens collected by me at Ajer Mantjor (P. S. No. 519).

VAR. ζ BORNEENSIS. Rather robust; sheathed stem 15 mm. in diameter, rather powerfully armed; the leaflets very irregularly set but not so distinctly grouped as in type, relatively large and broad, the largest 25 cm. long, 25 mm. wide; the spathe has some reversed spinules on the margins near the base. To this belongs Merrill's No. 1771 from Sarawak.

VAR. η DIVARICATUS. This, established on Hallier's No. 2758 from Dutch Borneo, is a variety more distinct than all the preceding. The pinniferous part is about 60 cm. long, with 15—17 leaflets on each side of the rhachis, regularly arranged, those of one side exactly opposite to those of the other side, and the two forming a horizontal line; they are very narrow, the largest 22—25 cm. long, 12—14 mm. wide, very gradually acuminate to a slightly asymmetrical point, having a few centimeters from the apex, a small indentation on the lower margin, often rendered more visible by a few bristles at that point.

It is needless to note that the length of 18—30 ft. attributed to leaves of *C. laevigatus* in Hook f. Fl. Brit. Ind. is a "lapsus calami."

Plate 9.—Ceratolobus laevigatus *Becc.* (forma typica). Ridley's specimen with mature fruits, No. 12128, from Semangkok Pass.

Plate 10.—Ceratolobus laevigatus *Becc.* (forma typica). Portion of the sheathed stem with a leaf and a male spadix; portion of the sheathed stem with a female spadix; from Scortechini's No. 123b collected in Perak (Herb. Becc.)

Plate 11.—Ceratolobus laevigatus var. subangulatus *Becc.* Portion of the plant with a spadix in fruit and an entire leaf. From "Piante Sumatrane" No. 519 in Herb. Becc. This corresponds to *Calamus subangulatus* Miq.

CALOSPATHA Becc.

Becc. in Ann. R. Bot. Garden, Calcutta, xii, 232.

A calamoid dioecious polycarpic (?) palm, apparently of the habit of a *Daemonorops* *Stem* . . . . . *Leaves* . . . . . *Male spadix* . . . . . *Female spadix* (or its partial inflorescences?) short, furnished with several persistent subdistichally imbricate large spinous spathes, each of which, except the lowest, embraces a floriferous branchlet. The outer or lowest spathe sheaths a short peduncular part, and only partially envelopes the others. Flower-bearing branchlets shorter than the spathes, slightly divided, sheathed by short spathels as in *Daemonorops*, and bearing alternate female flowers, provided with involucrophorum and involucre; apparently the female flowers are not accompanied by neuter ones, as no areola for their insertion is visible; in any case the areola is inconspicuous. *Female flowers* (judging from the fruiting perianths) have the calyx short, with 3 acute points; the corolla is longer than the calyx and very deeply 3-parted; the sterile stamens form with their connate filaments a shallow 6-radiate cup; ovary (judging from the fruit) globular, having a short thick style and thickly subulate internally lamellate stigmas. *Fruit* containing 2—3 seeds, globular, clothed with appressed scales, shortly and stoutly beaked, and crowned by the recurved permanent stigmas. *Seeds* enveloped by a very scanty integument; the testa smooth; the chalazal fovea indistinct; albumen homogeneous; embryo basal.

Calospatha Scortechinii Becc. in Ann. Roy. Bot. Gard., Calcutta, xii, 232.

Daemonorops Calospatha Ridley, Mat. Fl. Mal. Penins. ii, 176 (partly?).

Description.—The only specimen available is an apparently entire lateral fruiting spadix, 35 cm. in length, having a short flattened pedicellar part, 8 mm. wide, covered irregularly with light brown, straight, flattened spines, 10—25 mm. long; the lowest spathe is oblong, 15 mm. in length, about 3 cm. wide, of a firmer texture than those which follow, but of the same colour and appearance, and covered all over outside with scattered unequal spines. The spathes suffulting the floriferous branchlets are about 10 in number, of a deep cinnamon-brown colour, dry, subfoliaceous, thinly rigid-papyraceous, very minutely rusty-furfuraceous outside, almost polished inside, oblong, very shortly sheathing at the base, otherwise explanate, with a broad apex which very suddenly narrows into a long subulate beak; the latter armed with conspicuous spreading straight, flattened, light brown spines, 10—15 mm. long, having a bulbous base; the lower spathes have the blade 10—12 cm. long, 3 cm. wide, the beak 7—8 cm. long, and are more or less

spinous, especially towards the apex; the succeeding spathes become gradually smaller and less spinous, and are more shortly beaked. The floriferous branchlets are shorter than their respective spathes, 2—5 cm. long, and usually have a smaller branchlet at their base; their axial part is thickish, sinuous, speedily narrows above and carries very few flowers; the spathels are annular-cyathiform, truncate, slightly produced at one side; involucrophorum shallowly cupular; involucre slightly exceeding the involucrophorum, shallow, subdisciform and entire. *Female flowers* 7 mm. long. *Fruit* globular, slightly broader than high, and very obsoletely 3-lobed, 2 cm. in diameter, shortly and stoutly beaked, crowned by the permanent circinnate stigmas, 5 mm. long; scales in about 24 vertical series, very appressed, uniformly shining black in the exposed part, straw yellow in the posticous covered part, with a V shaped depression along the centre; the apex, acute but not produced; the margins obsoletely erosely-toothed. The few fruits examined contained 2—3 seeds; when the seeds are 2 in number, they have a flat inner face and convex dorsum; when there are 3, they have the dorsum also convex, and two inner faces separated by a salient angle; are about 12 mm. long, and 6 mm. thick; when cleansed from the thin, apparently once slightly fleshy integument, their surface is almost even, dull dark brown, and with an inconspicuous punctiform chalazal fovea. *Fruiting perianth* explanate; the calyx entire with the base slightly thickened; the divisions of the corolla twice as long as the calyx, elongate and triangular.

HABITAT.—Father Scortechini collected of this curious and very interesting Palm, only one fruiting spadix (or a partial inflorescence of it?) in the state of Perak, probably on Gunong (Mount) Bubu, but the label accompanying the specimen evidently belongs to another plant. Ridley gives for his *Daemonorops Calospatha* the locality of Gunong Kelendang, which is also in Perak.

OBSERVATIONS.—It is a very distinct Palm, not allied to any other known to me; apparently related to *Daemonorops*, from which it differs mainly in its fruit with 2—3 seeds, having a homogeneous albumen, a character not encountered in any species of *Daemonorops*. The peculiar structure and disposition of its spathes approaches *Calospatha* to *Plectocomia*, but apparently the first has lateral, non-terminal inflorescences; furthermore all *Plectocomias* have smooth (not spinous) spathes.

The description given by Ridley of the fruiting spadix of his *Daemonorops Calospatha* is exactly that of the type specimen of *Calospatha Scortechinii* existing in my herbarium; of this specimen a drawing was sent by me to Kew, precisely under the name of *Calospatha Scortechinii*, together with my manuscript notes for the "Flora of British India," wherein however this Palm was not included.

Ridley gives also the description of the stem and leaves of his *Daemonorops Calospatha;* but no leaves accompany in my herbarium the spadix described above, and I have not seen the leaves and the stem of the specimens that Ridley considers as belonging to the spadix he describes. Of this he says that the fruit is covered with orange scales having brown edges; whereas in my specimen the fruit is uniformly black. There is therefore some ground for doubt, as to the complete identity of *Daemonorops Calospatha* Ridley with *Calospatha Scortechinii* Becc.

PLATE 12.—Calospatha Scortechinii *Becc.* The entire type specimen in Herb. Beccari.

PLECTOCOMIA MART. ET BL.

Mart. et Blume in Schult. Syst. Veg. vii, 2, 1333; Mart. Hist. Nat. Palm. iii, 198, t. 114, 116, f. 1; Blume, Rumphia, iii, 68, t. 158, 159, 163; Griff. in Calc. Journ. Nat. Hist. v, 5, 95 and Palm. Brit. Ind. 103, App. XXI, t. 217, 218, 219; Miq. Fl. Ind. Bat. iii, 78, and Prodr. Fl. Sum. 592; Kurz. For. Fl. Brit. Burma, ii, 514 and in Journ. As. Soc. Beng. xliii, II, 207 t. xvi—xxvii; T. Anders. in Journ. Linn. Soc. xi, 11; H. Wendl. in Bot. Zeit. 1859, 165; Bot. Magaz. t. 5105; Hook. et Benth. Gen. Plant. iii, 934; Hook. f. Fl. Brit. Ind. vi, 477; Ridley, Mat. Fl. Mal. Penins. ii, 219; Rendle in Journ. of Bot. 1897, 73; Brandis, Ind. Trees, 649; Gamble, Man. Ind. Timb. 737 (2nd ed.).

Large climbing, monocarpic, diœcious, spinose, calamoid palms, ending in a terminal inflorescence composed of several partial panicles, issuing from the axillas of the uppermost, gradually much reduced leaves. *Leaves* of the adult plant terminating in a clawed cirrus, pinnate. *Leaf-sheaths* elongate, not flagelliferous, not gibbous above, and gradually passing into the petiole without axillary ligula and without ocrea at the mouth. *Leaflets* lanceolate or linear-lanceolate, acuminate, unicostate and usually furnished on each margin with a nerve about as strong as the mid-costa; secondary nerves slender; no spines or bristles on the mid-costa and lateral nerves; lower surface without scales or microlepidia, frequently discolorous. *Male* and *female* partial inflorescences or panicles similar, simply branched; the branches very long, spiciform, pendulous, having some tubular spathes in their basal part, otherwise entirely covered with closely imbricating, distichous, thinly coriaceous, persistent, concave spathels, embracing and shielding in their axillas the spicate diœcious flowers. *Spikelets* shorter than their respective spathels; male many-flowered; female shorter, few-flowered, both provided with small bracts and bracteoles. The male spikelets have two collateral flowers at each indenture of their small slender rhachis. *Male flowers* slightly asymmetrical; the calyx campanulate and 3-toothed, or shallow and trigonous; the corolla several times longer than the calyx, parted nearly to the base into 3 valvate, cartilaginous, acuminate petals, stamens normally *6*, resting on a short torus and subulate from a thickened base; anthers narrow, erect, with parallel cells; rudimentary ovary very small. *Female flowers* much larger than the male ones; the calyx cupular, more or less deeply 3-toothed or 3-parted; the corolla longer than the calyx, cupular or ventricose in its lowest part, divided in the remainder into 3 acuminate segments; the staminodes form with the connate bases of their filaments a shallow cup, divided into 6 radiating teeth, each supporting a sterile although rather well conformed anther. *Ovary* globose or ovoid, covered with scales, and having 3 dissepiments, early absorbed, and finally unilocular; ovules 3, basilar, usually only one evolving; style very short or obsolete; stigmas elongate, thick, fleshy, subulate. *Fruit* globose; pericarp thin and brittle, covered with numerous small scales, frequently fimbriate. *Seed* globular or globular-depressed, covered with a scanty integument more or less fleshy, and erect in the

pericarpal cavity; the hilum small, basal; the surface equable or nearly so (not pitted); chalaza apical; the raphe short; albumen homogeneous; embryo basal. *Fruiting perianth* persistent, hardening.

A very natural and well characterized genus, not having marked affinities with the other climbing Calamoid palms, on account of the peculiar structure of the spadix. The sterile plants however are with difficulty distinguishable from *Plectocomiopsis* and *Myrialepis*, having, like these, leaf-sheaths without flagella and ocreæ, gradually passing into the petioles, without gibbosity at the base of these, and leaflets unicostate with thickened margins; *Myrialepis* and *Plectocomiopsis*, however, have the lower surface of the leaflets dotted with minute microlepidia, which are always absent in *Plectocomia*. The long pendulous spikes, very regularly covered with approximate imbricate spathels protecting the small spikelets, form the most striking characteristic which serves to distinguish *Plectocomia* from all the other *Lepidocaryeæ*.

It has been a subject of discussion if in *Plectocomia* the inflorescence is terminal or axillary. In fact the *Plectocomias* are all without exception monocarpic palms, or in other words the stem that has produced an inflorescence perishes after the maturity of the fruits; but the inflorescence is frequently composed of several partial panicles, each coming forth from the axil of a leaf, which in the lower panicles is very similar to the cauline ones, but becomes gradually smaller in the upper panicles and is finally much reduced in those of the end.

Geographical distribution.—The *Plectocomias* are exclusively N.-E. Indian and Indo-Malayan palms, being found in the Eastern Himalaya, Assam, Burma, Siam, Cochin-China, the Malay Peninsula, in continental Asia, and in the Islands of Singapore, Sumatra, Java, Billiton, Borneo and Mindanao. The most northerly species *P. himalayana*, which grows luxuriantly in Sikkim, has no marked affinities with those of the not very far distant Khasia Hills (*P. khasiana*) and of Assam (*P. assamica* and *P. bractealis*); on the contrary these last three, together with *P. Kerrana* from N.-W. Siam and *P. Pierreana* from Cochin-China constitute a distinct group, having manifest affinities in common. Another group of allied species is formed by *P. macrostachya* of Lower Burma, *P. Griffithii* of the Malay Peninsula, and *P. elongata* of Java and Sumatra.

A third group is composed of *P. Muellerii*, a Bornean plant, of its ally *P. billitonensis* of Billiton, and of *P. Elmerii*, growing in Mindanao; this last having evidently a common origin with *P. Muellerii*.

KEY TO THE SPECIES.

A. *Calyx of the male flowers campanulate or cyathiform: of the female flowers ovoid-campanulate, coriaceous, with obconical, solid and hard base.*

I. Fruiting perianth having the base obconical, but not pedicelliform in the fruiting stage. The calyx in the male flowers tomentose at the mouth. Leaflets mealy-white beneath. Fruit woolly from the fimbriate upturned tips of the scales.

* Female spikelets composed of 3—5 flowers. Fruit 25—28 mm. in diameter. Male flowers 10—11 mm. long, sessile.

1. P. elongata Mart.—Java and Sumatra.

P. elongata VAR. **bangkana** Becc. Bangka.

A smaller plant.

** Female spikelets composed of 5—9 flowers. Fruit 15—16 mm. in diameter.

2. P. Griffithii Becc. Malay Peninsula, Singapore.

*** Male spikes larger than in the two preceding species and with larger spathels (7 cm. long). Male flowers also larger, 12—15 mm. long, distinctly pedicellate. Female flowers and fruit unknown.

3. P. macrostachya Kurz. Lower Burma.

II. Female flowers having the calyx tapering to a narrow base which later forms a conspicuous pedicel to the fruit. The calyx of the male flowers glabrous at the mouth.

* Female flowers 12 mm. long (not including the stigmas), having a scabrid pedicel and calyx ; the calyx before and during the anthesis suddenly expands into a cupular 3-toothed limb. Female flowers (not including the stigmas) 12 mm. long. Fruit hairy. Upper leaves having lanceolate, acute, or shortly acuminate leaflets, green on both surfaces.

4. P. Muellerii Bl.—Borneo.

** Female flowers 10 mm. long, having the calyx smooth and glabrous, parted before and during the anthesis into 3 ovate segments. Ovary densely hairy. Upper leaves having elongate-lanceolate or ensiform very long-acuminate leaflets, green above, rusty-furfuraceous beneath.

5. P. billitonensis Becc.—Billiton.

*** Female flowers 18—20 mm. long, having the calyx tapering to a long and narrow pedicelliform lower part, and the limb 3-parted. Leaflets lanceolate, acuminate, destitute of any kind of indumentum underneath. Fruit globular depressed, mammillate, smooth, the scales not fimbriate.

6. P. Elmerii Becc.—Mindanao.

B. Calyx of the male flower shallow, trigonous or 3-toothed; of the female flower thinly cartilaginous, cupular, not thickened at the base. Fruiting perianth explanate.

I Leaflets green on both surfaces.

Leaflets terminated by a filamentose tip. Spathels (of the male and female spadix) twice as long as broad, finely tomentose outside. Fruit globular, rounded above, not mammillate, 15 mm. in diameter; scales appressed, not fimbriate.

7. P. *himalayana* Griff.
Sikkim Himalaya.

II Leaflets green above and distinctly mealy-white beneath, acute or acuminate but not having a filamentose tip.

* Spathels tomentose externally.

† Axis of the spikes and spikelets densely rusty-tomentose. Female flowers having a very short pedicel provided with small bracts, 4—5 mm. long, and having the divisions of the corolla much longer than the calyx. Fruit slightly conically-beaked, densely villose.

8. P. *assamica* Griff.—Assam.

†† Axis of the spikes and spikelets densely rusty-tomentose. Female flowers pedicellate, provided with conspicuous bracts 10—15 mm. long, and having the calyx split from the base into triangular acuminate segments, slightly shorter than the corolla. Ovary densely villose.

9. P. *bractealis* Becc.—Assam.

††† Axis of the spikes and spikelets glabrescent. Fruit of smooth appearance covered with scales having the margins simply fimbriate and the tip not crisped.

10. P. *khasiana* Griff.—Khasia Hills.

** Spathels entirely glabrous.
Axis of the spikes and spikelets scabridulous. Fruiting perianth with a very small trigonous calyx, several times shorter than the corolla. Fruit of smooth appearance, slightly squarrose, the scales having short ciliate tips. Seed exactly spherical.

11. P. *Kerrana* Becc.—Siam.

III Leaflets slightly paler below than above.
Spathels glabrous. Fruit slightly squarrose, exactly spherical, having the scales very minutely ciliate-fringed. Fruiting perianth explanate with trigonous 3-toothed calyx; the corolla thrice as long as the calyx. Seed slightly depressed.

12. *Pierreana* Becc.—Cochin-China.

Description of Plate I—B.

1-4. Plectocomia elongata *Mart. & Bl.*—Fig. 1.—Female flower. Fig. 2.—Male flower. Fig. 3.—Section of a male flower showing a petal and the two stamens opposite to it. Fig. 7—A stamen from the dorsum (Fig. 1) enlarged 4, the others 6 diameters).

Fig. 5. Plectocomia bractealis *Becc.*—Female flower (× 4).

Fig. 6. Plectocomia assamica *Griff.*—Female flower (× 4).

Fig. 7. Plectocomia Kerrana *Becc.*—Male flower (× 6).

Excluded Species.

Plectocomia sumatrana Miq. Prodr. Fl. Sum. 592=*P. elongata* Mart. et Bl.?

This species was established on very scanty material, consisting mostly of very juvenile inflorescences, of which I have seen a portion from the Utrecht Herbarium, and another portion of the same collecting from Buitenzorg; this last had the label in Teijsmann's hand-writing—"No. 2034. Sitabœ, Paya Kombo." One leaflet united to fragments of a spike exactly corresponds to the fragments of *P. elongata* Mart. from Java.

Descriptions of Species.

1. Plectocomia elongata Mart. and Bl. in Roem. et. Sch. Syst. Veg. vii, 1333; Mart. Hist. Nat. Palm. iii, 198, t. 114 and 116, f. 1; Kunth, Enum. Plant. iii, 202; Blume, Rumphia iii, 68, t. 58 and 163 A, Miq. Pl. Jungh. i, 161; Fl. Ind. Bat. iii, 79; Prodr. Fl. Sum. 255: De Palm. Arc. Ind. 27; Hook. f. Fl. Brit. Ind. vi, 479; Ridley, Mat. Fl. Mal. Penins. ii, 220; Heyne, Nutt. Plant. v. Nederl. Ind. (1913) 103.

P. sumatrana Miq. Prodr. Fl. Sum. 255, 592; De Palm. Arc. Ind. 27.

Calamus maximus Reinw. in Bl. Cat. Hort. Bog. 59.

Description.—A gigantic climbing palm up to 30 m. high at the flowering time. The *sheathed stem* as thick as the arm. The *leaf-sheaths* in young plants are obliquely truncate at the mouth, have no ocrea or ligula, are clothed in the lower covered part with a dense cottony yellowish-white tomentum, and are unarmed above; in the adult plant the leaf-sheaths are very thick and woody, armed, at least in their uppermost part, along the dorsum, with a line of digitate spines, having very thick confluent bases, and slender brittle filiform points. *Leaves* very large; the pinniferous part in the adult plant 2—3 m. long; the petiole short and stout (20 cm. long in one specimen) concave-convex with acute margins; rhachis very robust, in its lower portion 5 cm. wide or thereabouts, broadly channelled aobve, convex beneath, with flat margins 5 mm. wide, upon which are inserted the leaflets; the dorsum is armed, like the petiole, with, at first binate, but higher up solitary robust spines, changing above into claws; on the margins the spines are usually digitate or in small series of 3—6, straight and slightly deflexed; upwards the rhachis becomes obsoletely angular and towards the apex subterete and at the same time gradually becomes more powerfully armed with half whorls of very robust confluent claws; the cirrus is some metres long and extraordinarily robust, 8—9 mm. in diameter where the leaflets cease, and it is uncommonly powerfully armed with very sharp blacktipped claws, 8—10 of which are connate by their broad swollen

bases and form nearly complete regularly spaced whorls. *Leaflets* in distant groups of 2—4 on each side of the rhachis, narrowly lanceolate, very gradually acuminate above to a long subulate apex and almost equally narrowing to the base; all are on one plane and have a distinct callus with transverse rima in their axillus; are green above and ashy-grey beneath, especially in recently expanded leaves, less distinctly so with age; the mid-costa and the marginant nerves are raised and almost equally robust on the upper surface; the secondary nerves slender; transverse veinlets obsolete; the margins smooth or occasionally very minutely (and deciduously?) spinulous. The intermediate leaflets of the adult plant are 50—65 cm. long; 3—4 cm. wide; but apparently the size of the leaflets varies with the age of the plant and with the level at which the leaves are inserted along the stem; for one reason or another in some specimens the leaflets appear smaller and relatively broader than described above; the lowermost leaflets are usually smaller and narrower than the intermediate. The *inflorescence* is terminal, on the whole very large and composed of several spadices springing from the axils of the uppermost leaves. The *male* and *female spadices* are produced on distinct plants; they are however very similar in general character. The partial inflorescences are 1—2 m. long, recurved and composed of several pendulous spikes, each issuing from the axilla of a spathe; the lowest spathe is infundibuliform, 15 cm. long (in one specimen), cottony-tomentose, slightly flattened, 2-horned or produced above on each side into a broad triangular incurved point; the succeeding spathes are shorter, also infundibuliform, but obliquely truncate at the mouth and produced only at one side into a broad triangular acuminate point; the spikes when still young have the appearance of long terete scaly tails with approximate closely inbricate spathels. The *male spikes* during the anthesis are 75—90 cm. long; have a terete slender axis 3—4 mm. in diameter, rendered scabrid by hard, short, branched, rusty hairs, and bear alternately and distichally very numerous bracts (spathels) which at first overlap each other and are imbricate in their basal parts, but spread or gape during the anthesis, and are spaced 1 cm., that is, on a portion of the axis of the spike 10 cm. in length are attached 5 spathels on each side; the spathels are concave, very broadly ovate or more or less rhomboidal in general outline, have the apex acute and taper below to a narrow base; from about the middle upwards are broadly triangular, are 4·5—6·5 cm., long, and about as broad or less, thinly coriaceous, reddish brown in the dry condition, very finely striately veined, glabrous in their basal part, and more or less sprinkled with appressed hyaline scales above; generally the place of separation between the lower broadest part and the triangular point is marked on each side by an acute angle or a small tooth, very distinct in the lower and intermediate spathels, but obsolete in the upper ones; spikelets 4—5 cm., long, with a slender zig-zag sinuous hairy scabrid axis, alternately and distichally indented, and bearing at each indentation or notch two collateral flowers; the pairs of flowers are 5—9 on each side of the axis, the lowest pairs being shortly pedicellate, all the others sessile and suffulted by a small subulate bract; moreover, each flower has its own, although inconspicuous bracteole. *Male flowers* trigonous, sinuous-lanceolate, slightly asymmetrical, acuminate, 10—11 mm. long, 4—5 mm. broad, the calyx broadly campanulate, 3 mm. high, shortly 3-toothed, villose on the margin, the teeth subulate; the corolla is

nearly 4 times as long as the calyx, parted nearly to the base into 3 broadly lanceolate-sigmoid or at times nearly elongate-rhomboidal, acuminate, thinly coriaceous segments; stamens 6, erect on the short solid base or torus of the corolla; filaments having a thick bulbous base suddenly finely subulate; anthers linear, 5 mm. long, sinuous, obtuse at both ends, erect, inserted on the dorsum below the middle, reaching with their apices above midway of the petals; their cells parallel, disjointed below the middle; rudimentary ovary represented by 3 very small linear papillæ. *Female spikes* very similar to the male, but more robust and with slightly larger and more rigid spathels. *Spikelets* composed of only 3—5 flowers; each flower is suffulted by a short trigonous, rusty scabrid pedicel, 3—4 mm. long, and is provided with a triangular subulate bract, 2—3 mm. long. *Female flowers* much larger than the males; the calyx coriaceous, ovoid-campanulate, tapering slightly to the base, 7—8 mm. broad, and about as long, broadly 3-toothed, the teeth triangular acute, the entire margin covered with dense rufous villosity, deciduous in age, the surface obsoletely minutely punctulate, otherwise smooth or not distinctly veined; the corolla twice as long as the calyx, its base only entire and lining the lower part of the calyx, otherwise parted into three hard cartilaginous segments, suddenly becoming linear-lanceolate and acuminate from a broad triangular base; the stamens form with their expanded connate bases a shallow membranous cup, adhering to the base of the corolla, and divided into 6 triangular teeth, having subulate apices and carrying sterile anthers; the latter linear or very slightly sagittate and with their apices reaching to midway of the segments of the corolla. The ovary is globose and very densely covered by the hairy tips of the scales; stigmas sessile or distinct even from the base, elongate, sinuous, subterete, protruding considerably beyond the corolla even before the anthesis. *Fruits* 1—3 at each spathel, globular, when quite mature 25—28 mm. in diameter, bearing on the round top the remains of the bases of the stigmas, but not beaked, very densely villous from the long, narrow, upturned or spreading rufous membranous finely laciniate-fimbriate tips of the scale; the scales are arranged in very numerous series, are dark chestnut brown, polished, slightly convex and narrowly grooved along the centre. *Seed* usually solitary, globular-depressed, about 15 mm. in diameter. The *fruiting perianth* is not accrescent, but the calyx narrows a little at the base and forms a short obconical pedicel to the fruit.

HABITAT.—The typical plant is indigenous to Java, but apparently with unchanged characters it grows also in Sumatra. In Java it is encountered in the damp virgin forests of the volcanic mountains of Bantam, where it is known to the natives by the names of "Bubuai," "Buai" or "Buan" (Miquel). In the Residency of Preanger at Tijbodas (*Boerlage* in Herb. Becc.—male specimen); at Palabuanratu (*Koorders* Nos. 34575B, 34587B, 3166B); on Mt. Salak (*Heyne* No. 52 in Buitenzorg and Beccari Herbaria); on the mountains, without special locality, at 1200 m. elevation (*Zollinger* No. 1380 in Herb. de Candolle with female flowers); in the Residency of Semarang at Ungaran Telomajo (*Koorders* No. 35993 in Buitenzorg Herbariums—pecimen with mature fruits).

From Sumatra I have seen only very incomplete specimens. One with male flowers collected by *Dr. C. D. Ouwchoud* in July 1897 at Toba, 1350 m. alt. in

the Battaksland in West Sumatra (No. 390. Buitenzorg Herbarium) seems to agree quite well with the Javan plant. The specimen collected by Teijsmann at Paya Kombo in West Sumatra (No. 2034 Buitenzorg Herbarium) upon which Miquel established his *P. sumatrana* has the spikes so young that the flowers are not yet visible; but I am unable to distinguish them from the spikes of the Javan specimens of the same age.

Observations.—The diagnostic notes of *P. elongata* are: leaves with leaflets in groups of 2—3. green above, whitish beneath; male spadix with spathels deeply concave, obovoid-rhomboidal, acute, about as long as broad, glabrous in their basal part, more or less sprinkled with appressed hyaline scales above, the axial part of the spike, of the spikelets and the pedicels of the flowers scabrid; the male flowers 9—11 mm. long with very small bracteoles and tomentose margin to the calyx; the female flowers 3—4 at most at each spathel, shortly pedicelled and with very small bracteoles; the fruiting perianth broadly obconical subpedicilliform; the fruit woolly, globose, 25—28 mm. in diameter, terminated by the small remains of the sessile stigmas but not beaked; the scales narrowly grooved along the centre, prolonged into a long membranous laciniate-fimbriate upturned or spreading point; the seed globular-depressed, about 15 mm. in diameter.

I have described the male spadix from Boerlage's specimen collected at Tijbodas, and the female one from Zollinger's specimen. The leaflets are very variable in size. In Boerlage's specimen they are 44 cm. long, 4 cm. wide, and have the margins, and especially the apex minutely spinulous; the same character is present in all the specimens collected by Koorders, in which however the leaflets are broader, distinctly lanceolate or elliptical-lanceolate, 40—45 cm. long, 5—7 cm. broad; all are distinctly mealy beneath; but in a young leaf of Heyne's No. 52 from Salak the leaflets have quite smooth margins as have those that are united to the fruiting specimens from a plant cultivated in the Botanic Garden of Calcutta, distributed under the name of *P. assamica*, gathered 14th March 1891, but which I confidently refer to *P. elongata*. In these specimens some of the fruits contain 2—3 seeds, and have a slightly 2—3 lobed shape; the pericarp on the whole is about 1 mm. thick and has the cavity glossy, neatly marked by 3 fine raised lines corresponding to the absorbed dissepiments.

Plate 13.—Plectocomia elongata *Mart. & Bl.*—An entire male spike; portion of the upper part of the rhachis; one leaflet. From Boerlage's specimen in Herb. Beccari.

Plate 14.—Plectocomia elongata *Mart. & Bl.*—An entire spike with nearly mature fruits; the base of a leaf; intermediate portion of the rhachis with two leaflets; detached fruits, one opened with two seeds; from the Calcutta cultivated specimen of 14th March 1891. One spathel with its female spikelet and detached female flowers; from Zollinger's No. 1380.

Plectocomia elongata *Bl.* var. bangkana Becc.

Description.—Apparently smaller than the Javan plant. *Leaves* also with smaller leaflets, distinctly greyish or subochraceous-pulverulent beneath, lanceolate

or suboblanceolate, acuminate, 30—33 cm. long, 4·5—5 cm. broad, the margins quite smooth. *Male spikes* 70 cm. long, compound (occasionally?), viz., producing frequently secondary spikelets at the axillas of some spathels; the latter obovoid rhomboidal as in type, but somewhat smaller, the largest 5 cm. long, 3 cm. wide, the secondary spikes 6—7 cm. long at most, bearing on each side 6—8 small spathels but of the same shape as the others; the primary spikelets are about 2—2·5 cm. long and have 4—5 pairs of flowers on each side; the secondary spikelets are very few flowered. *Male flowers* 7—8 mm. long, 3 mm. broad; anthers linear, 2·5 mm. long, reaching about midway of the petals. *Female spikes* also as in type, but with smaller spathels. The *female flowers* distinctly pedicellate, 5 at each spathel, slightly smaller than in type and having the calyx more attenuate to the base and faintly striately veined outside. The mature fruit not seen by me, probably smaller than in type.

Habitat.—The Island of Bangka at Baturuak (*Kurz* in Herb. Calc.); collected also with immature fruit by *Teijsmann* in Oct. 1872 (Herb. Bogor.) Malay name "Bebuwar". The male plant introduced from Bangka is cultivated in the Botanic Garden at Buitenzorg.

Observations.—Apparently it forms the link with *P. Griffithii* Becc. The male flowers of the plant cultivated at Buitenzorg have anthers considerably smaller than those of the flowers of the Javan plant (2·5 mm. instead of 5 mm.)

Plate 15.—Plectocomia elongata var. bangkana Becc.—Branch of the male inflorescence, with spikes bearing secondary spikelets; upper portion of a leaf from the specimen cultivated at Buitenzorg introduced from Bangka. Portion of the spike with immature fruits collected by Teijsmann in October 1872.

2. Plectocomia Griffithii Becc. in Hook., f. Fl. Brit. India, vi, 478; Ridley, Mat. Fl. Mal. Penins. ii, 220; Rendle in Journ. of Bot. 1897, 73.

P. elongata (not of Mart. or Bl.) Grifl. in Calc. Journ. Nat. Hist. v, 96; Palms Brit. Ind. 104, t. 217 A. B. C.

Description.—Stem, leaves, leaf-sheaths, petioles and cirrus as in *P. elongata*, of the same large dimensions and equally spiny. *Leaflets* usually in groups of 2—4 on each side of the rhachis, paler or whitish beneath. *Male* and *female spadix* on the whole also as in *P. elongata*, but apparently the male spikes have slightly smaller spathels. *Female spikes* can also be described with the same words as for *P. elongata*, concave, subrhomboidal, acute, the largest 5—6·5 cm. long and somewhat less wide, often marked with an acute tooth about midway of the sides, dividing the upper triangular part from the lower, and sprinkled with small applied scales. The main axis, and the pedicels of the flowers are scabrid and rusty. The female spikelets are composed of 5—9 more or less distinctly pedicellate flowers; bracts very small. *Female flowers* not differing from those of *P. elongata*; the calyx coriaceous, ovoid-campanulate, slightly tapering to the base, 7 mm. wide and about as long, the margin villous, broadly and not deeply 3-toothed, the teeth acute;

corolla twice as long as the calyx, smooth or slightly striately veined; stamens having sterile linear slightly sagittate anthers, reaching with their apices to midway of the segments of the corolla. *Fruits* 3—5 at each spathel, globular, when quite mature 15—16 mm. in diameter, bearing on their tops the remains of the bases of the stigmas, but not beaked, very densely villous from the long narrow spreading or upturned, rufous, membranous, finely laciniate-fimbriate tips of the scales; the latter are arranged in very numerous series, are dark chestnut-brown, polished and slightly depressed along the centre. *Seed* globular-depressed, 11 mm. long, 9 mm. broad, 7·5 mm. thick. *Fruiting perianth* broadly obconical, narrowing a little to a subpedicelliform base.

HABITAT.—The Malay Peninsula and Singapore. The specimens figured by Griffith were obtained from the forests near the sea-shore at Kundur near Malacca. In the district of Perak (*Scortechini* in Herb. Becc.); Penang Hill at 600 m. elev. (*Ridley* No. 7098 in Herb. Calc.). In Singapore (collected in 1878 by *F. Keheding*—Herb. Becc.); Bukit Mandai (*Ridley* No. 3470 in Herb. Perak); from Singapore *Ridley* gives also the following numbers which I have not seen: No. 3487—Garden Jungle; No. 1665—Koranji Selitar. He quotes also the locality of Mt. Ophir at 1,000 m. elev., and Gunong Kelendang in Perak.

OBSERVATIONS.—*P. Griffithii* is very closely related to *P. elongata* Bl., and may be considered as a geographical or representative species of the latter. It differs from *P. elongata* in having the female spikelets composed of more numerous flowers (5—9 instead of 3—4), and in the smaller fruit (15—16 mm., instead of 25—28 mm. in diameter), and smaller and apparently more flattened seed. Probably also it differs from *P. elongata* in having the male spikes with smaller spathels, smaller male spikelets, and fewer flowers with shorter anthers. I have not however seen male spadices which could be referred with certainty to *P. Griffithii*; probably however some specimens belong to it which Mr. Ridley forwarded to me, I do not know if gathered from wild growing plants in the primitive Garden jungle, or from cultivated individuals (they bear the date March 1905). In these specimens the leaflets are narrowly lanceolate, 55—65 cm. long, 5 cm. wide, greyish beneath, in the lower part of the rhachis in alternate groups of 3—4; several of the lowest leaflets are furnished on the upper margin and at times also on the lower with one or occasionally two robust conspicuous spines. The male spikes are 70—75 cm. long, have the main axis slender (2 mm. in diameter) and the spathels smaller than in the specimens of *P. elongata* from Java, are 3—3·5 cm. long, 2—4·5 cm. wide, and more closely set than in the latter, the spathels being seven in number (instead of 5) attached to each side of the main axis for the space of 10 cm. The spikelets are 20—25 mm. long, have a very slender axis and carry 5—6 pairs of sessile flowers. The flowers are 9 mm. long and 4 mm. broad, have the anthers linear, 3—3·5 mm. long reaching with their apices about midway of the spathels.

PLATE 16.—Plectocomia Griffithii *Becc.*—An entire spike with immature fruits and portion of a leaf from near base from Penang Hill (Ridley's No. 7098 in Herb. Calcutta). The upper part of a spike with thoroughly mature fruits and one seed; from Keheding's specimen collected in Singapore.

PLATE 17.—Plectocomia Griffithii *Becc.*—Branch of a male inflorescence, supposed to belong to that species ; spathel with its male spikelet ; detached male spikelet ; portion of a leaf from near its base : observe the spine near the base of the leaflets. From Ridley's specimen gathered March 1903.

3. PLECTOCOMIA MACROSTACHYA Kurz, Enum. Burm. Palms in Jour. Asiat. Soc. Bengal, xliii, pt. II (1874), 207, t. xvi, xvii : For. Fl. Brit. Burma ii, 514 ; Hook. fl. Fl. Brit. Ind. vi, 478 ; Brandis, Indian Trees, 650 ; Gamble, Man. Ind. Timb. 2nd ed. 737.

DESCRIPTION.—A large and lofty climber (Kurz). *Leaves* with alternate groups of 2—3 leaflets on each side of the rhachis ; the rhachis in a portion above the middle is very obsoletely angular and minutely scabrid when seen under a lens. The intermediate *leaflets* of the adult plant are lanceolate or narrowly elliptical-lanceolate, equally tapering to both ends, the broadest part being about their middle, and gradually acuminate above ; are 60 cm. long, 6—6·5 cm. wide, conspicuously discolorous or white beneath, have a robust mid-costa and an equally strong primary nerve running along the margins ; secondary nerves very fine, 8—9 on each side of the mid-costa, regularly spaced ; transverse veinlets obsolete ; the *male spikes* are described by Kurz, 4—5 ft. long (1·2—1·5 m.) ; in the portions seen by me they are somewhat flattened and about 6 cm. thick ; the spathes are closely imbricate and on a portion of spike 20 cm. in length, I counted 7 spathels on each side ; the spathels are very rigid, coriaceous, of a dull chestnut brown colour, darker or blackish near the edges, very finely striately-veined, glabrous in their basal part, slightly scaly-furfuraceous above, concave, rhomboidal-obovate, the largest 7 cm. long, 5 cm. wide, often with an angle or tooth about the middle of the sides separating the upper triangular acute point from the lower basal part. The main axis of the spikes is 4—5 mm. in diameter, slightly scabrid-furfuraceous, at times almost smooth. Spikelets 4—5 cm. long, their axis scabrid-furfuraceous, slender, carrying usually 6 pairs of flowers on each side, the lowermost of which are supported by pedicels 2—4 mm. long ; the bracteoles are very small. *Male flowers* 12—15 mm. long, 4—5 mm. broad, sinuous-lanceolate, very acuminate, trigoncus ; the calyx broadly campanulate, 3 mm. high, shortly 3-toothed, the margin villose, the teeth subulate ; the corolla 5 times as long as the calyx, its segments cartilaginous-coriaceous, lanceolate, undulate, acuminate ; stamens with filaments connate by their thickened bases, suddenly subulate ; anthers linear, 4 mm. long ; rudimentary ovary very minute, represented by 3 linear papillæ. *Female spadix* and *fruit* not seen by me.

HABITAT.—Lower Burma on the Bithoko Range, between the Yunzalin and the Salween at the Great Rapids, at 1,000 m. (*Brandis* No. 539 in Herb. Calc.). Probably not uncommon elsewhere in Lower Burma (Brandis).

OBSERVATIONS.—Very imperfectly known. No doubt allied to *P. elongata* Bl. and *P. Griffithii* Becc., but with larger male spikes and flowers ; the male spikes of *P. macrostachya* being even larger and having larger and more coriaceous spathels than the female spikes of *P. elongata* ; further the male flowers are more distinctly pedicellate in *P. macrostachya* than in P. *elongata.*

I have seen of this species, probably the largest of the known species, only a portion of a leaf and two fragments of a male spike.

Sir Dietrich Brandis, the discoverer of the species, writes (l. c.) of it: "A lofty climber, internodes short, leaves 10, flagellum 2 feet long, leaflets approximate in pairs or in threes, white farinose beneath, lanceolate, 8—24 by 1½—3 inch, midrib and two longitudinal nerves close under the edge very stout, sheath and rhachis with straight slender spines up to ½ in. long, in groups of 2 or 3 or in half whorls, appendage of scales stiff linear. Branches of male spadix 4—5 ft. long, pendulous, closely covered with broadly obovate distichous imbricating spathels, brown with black border, in the axils of which are the spikelets, shorter than the bracts with alternate distichous fl. Calyx very shortly 3-toothed, limb woolly or ciliate, petals rigid, lanceolate mucronate, stamens 6. Fr. ¾—1 in diam."

PLATE 18.—Plectocomia macrostachya *Kurz.*—The entire type specimen in the Calcutta Herbarium. One half of a spathel showing in its axilla a male spikelet; male flowers.

4. PLECTOCOMIA MUELLERII Blume, Rumphia, iii, 7 t. 159; Miq. Fl. Ind. Bat. iii, 79. *P. rigida* H. Wendl. in Bot. Zeit. 1859, 165.

DESCRIPTION.—Of the usual general appearance but of rather small size. *Sheathed stem* 2—2·5 cm. in diameter. *Leaves* relatively small; one from the upper part of the adult plant and 90 cm. long in the pinniferous part has 28 leaflets on the whole and is terminated by a moderately long cirrus and has the petiole about 20 cm. long and 10 mm. broad at its base; the leaf-sheath is striate and provided with some slender digitate spines along the dorsum and at the sides of the mouth. The uppermost leaves or those immediately below the inflorescence are smaller than those described above, have fewer leaflets, are more briefly petiolate, and have quite unarmed leaf-sheaths; whereas the leaves of the lower part of the stem or of young plants are larger in every part and have the leaf-sheaths softly tomentose on their lower covered part, and glabrous on their exposed parts greenish, closely striate and rather densely armed with slender, feeble, unequal, pale, acicular spines, the largest of which are 10—15 mm. long and united by their bases so as to form transversely oblique, frequently interrupted series. The petiole is convex beneath, slightly concave near the base on the upper face, flat in the remainder; the margins are very sharp. The rhachis is obsoletely angular, armed with claws, solitary at first and then 2—3-nate, becoming half-whorled at very regular distances in the cirrus; petiole and rhachis glabrous or sprinkled with inconspicuous punctiform scales. *Leaflets* set in distant alternate, or subopposite groups of 2—4 on each side of the rhachis, lanceolate, elliptical-lanceolate or oblanceolate, usually narrowing more toward the base than upwards, are rather suddenly acuminate at apex, not quite explanate, that is slightly inflated or concave-convex, rather rigid-papyraceous, green on both surfaces, the margins smooth, thickened by a nerve stronger than the mid-costa; secondary nerves relatively strong, 5—7 on each side of the mid-costa. The intermediate leaflets in leaves of the upper part of the plant 15—20 cm. long, 2·5—3·5 cm. wide; the lower leaflets are slightly, and the upper considerably smaller; the leaves

immediately below the inflorescence have the leaflets still smaller and with the blade more distinctly swelled out, whereas those of the leaves of young plants attain 25—28 cm. in length and are 3·5—4 cm. in breadth. In young leaves the transverse veinlets are distinct, connect the secondary nerves, and are not very close together but in old leaves are obsolete, being submerged in the parenchyma. *Male spikes* 60—65 cm. long, inclusive of an arched basal part, which is furnished at the base with a tubular-infundibular spathe, and with several vacuous infundibuliform-amplectent spathels which gradually pass into those bearing the spikelets in their axillas; the main axis of the spikes is terete, sinuous 2 mm. in diameter; the spathels are very approximate, being only 6—7 mm. apart, concave, broadly rhomboidal, 2·5—3 cm. long and of about the same breadth broadest in their upper third part or a little above, and thence slightly narrowing below, and with a wide triangular point above; they are rigid-papyraceous or thinly coriaceous, of a dark chestnut-brown colour, finely striate, slightly scaly and furfuraceous outside. *Spikelets* very densely flowered, ovoid, 15—18 mm. long in the lower part of the spike, smaller above. *Male flowers* numerous, sessile, very closely packed, somewhat unequal, furnished with very small bracts, inserted all round the axis, very small, subtrigonous, narrowly lanceolate, 4—6 mm. long, 1 mm. thick, the lower acute, the upper bluntish; the calyx trigonous, cyathiform-campanulate, 1·5 mm. high, with 3 acute teeth, and glabrous margin; the corolla about 4 times as long as the calyx, parted nearly to the base into 3 linear-lanceolate segments, slightly sigmoid, acute or acuminate, cartilaginous, striate; stamens having the filaments united together at their bases, rigid and subulate in their free upper parts; anthers linear-sagittate; rudimentary ovary very minute *Female spadix* having shorter and more rigid spikes than the male (35—70 cm. long); the spathels are also more rigid, at times as much as 4·5 cm. long, and about as wide and very deeply concave; the main axis subterete, 2—3 mm. in diameter, slightly furfuraceous; the internodes about 15 mm. long; *spikelets* very short, usually having only 3 pedicellate flowers; the pedicels trigonous, 3—4 mm. long, scabrid-each furnished with a subulate bract 4—5 mm. long. The whole perianth of the female flowers 12 mm. long; the broadly obconical calyx has a hard solid base, tapers to a narrow trigonous pedicellar part and is rendered slightly scabrid by very short, rigid, branched rusty hairs, is expanded above into a 3-toothed limb, the teeth deltoid and acuminate; on the whole the calyx is 8 mm. long; the corolla is one-third longer than the calyx, has a shallowly cupular base, but otherwise is almost entirely parted into 3 rigid lanceolate-acuminate segments; the sterile stamens form with the confluent broadened bases of their filaments a very shallow cup, divided into 6 deltoid subulate teeth; anthers oblong or linear; ovary globular, clothed with hairy fringed scales; stigmas elongate-trigonous, subulate, connivent. *Fruit* 2 cm. in diameter, globular and slightly depressed, often very obsoletely 3-lobed, especially when young, distinctly beaked from the persistent remnants of the stigmas, 8—10 mm. long and resting on its very short broadly conical apex; scales shining, dark chestnut-brown, slightly convex, faintly groved along the centre, having ciliate-fringed margins, and being prolonged into a finely laciniate rufous appressed (not upturned) tip, giving on the whole a hairy, but not woolly, appearance to the fruit. The cavity of the crustaceous brittle pericarp is lined with a very thin membranous endocarp, showing traces of 3 dissepiments and of 3 cells, in one of

which and at the base is attached the seed, while in the two others the undeveloped ovules are visible. The *seed* is clothed with a fleshy rather abundant integument; when divested of this it is globular, somewhat depressed, 12 mm. broad, 9 mm. high, its surface is nearly even, dull; the chalaza is indistinct. Embryo basal, slightly on one side. The *fruiting perianth* has the calyx split above into 3 ovate acute lobes, and its base very conspicuously obconical and trigonous, forming a pedicel to the fruit, which owing to this addition assumes a general turbinate shape.

HABITAT.—Apparently a rather common plant in Borneo. The species was described by Blume from a male specimen collected by *Dr. G. Mueller* on Mount Sakumban in the S.-E. of the Island. In Sarawak (*Lobb* in Herb. Calc. This was the male plant described by Wendland as *P. rigida*); also in Sarawak on Mount Mattang near Kuching (*Becc.* P. B. No. 3038) and on Mount Santubong (*Hewitt* in Herb. Kew.-fruit). I have also seen specimens from Dutch Borneo in the Buitenzorg Herbarium collected by *Hallier* at Lianggagang (No. 2967 male specimen), on Gunong Kenepai (No. 1715 in fruit), and on Gunong Klam (No. 2358 with very young fruits).

OBSERVATIONS.—Somewhat variable in the size of the spadices, but especially in regard to the leaves, according to the age of the plant from which the specimens are gathered. In my Sarawak specimens (P. B. No. 3038) the leaflets of the adult fertile plant are small, 12—16 cm. long, 2·5—3·5 cm. wide. In a leaf of Hallier's No. 2967, apparently belonging to a not as yet fertile plant, some of the leaflets are 25—28 cm. by 3·51—4 cm. One leaf in Hallier's No. 1715 has larger and more acuminate leaflets than all the foregoing, being 52—55 by 6 cm.

P. Muellerii is distinguishable by its small size; by the leaves with not numerous leaflets in groups of 2—4 on each side of the rhachis, green and glabrous on both surfaces; by the spikes with very approximate broadly rhomboidal spathels, very concave, about as long as broad, slightly scaly outside; by the numerous male flowers very densely packed into ovate sessile spikelets, very small and slender, having cyathiform trigonous glabrous calyces; by the female flowers having an obconical calyx with hard solid base, prolonged into a narrow pedicel; by the fruit globular, slightly depressed, distinctly beaked, of a hairy but not woolly appearance, supported by the obconic fruiting perianth, which contributes to give the entire fruit a turbinate shape; by the scales with fimbriate-hairy tips, appressed and not upturned; by the globular-depressed, even-surfaced seed.

PLATE 19.—Plectocomia Muellerii *Bl.*—Portion of the sheathed stem; an intermediate portion of a leaf; a branch of the male inflorescence with an entire spike; a spikelet of male flowers. From Hallier's No. 2967.

PLATE 20.—Plectocomia Muellerii *Bl.*—The large spike with mature fruits from Hewitt's specimen (Herb. Kew.); the upper part of a plant with a spike and a leaf from Beccari P. B. No. 3038.

5. PLECTOCOMIA BILLITONENSIS Becc. sp. n.

DESCRIPTION.—*Sheathed stem* of the upper flowering part of the plant nearly 4 cm. in diameter. One *leaf*, from a young plant, has the leaf-sheath softly tomentose in the lower covered part, and thinly, apparently fugaciously, rusty-furfuraceous in

that exposed, and is armed with brown, needle-like, unequal, 5—15 mm. long spines, confluent by their bases and digitate or forming short radiating series; the petiole in that leaf is 30 cm. long, wide channelled above, armed in its lower part with the same kind of spines as the sheath, but larger and stronger; the rhachis is subterete and like the petiole is clothed with a soft, rather dense, tobacco-coloured indumentum, partly detachable, and along the dorsum has a line of single claws which become 2-3-nate above; the pinniferous part is 1·20 m. long; the *leaflets* are covered below with a thin coating of rusty scurf, apparently deciduous with age; are about 40 in all, the lower and uppermost solitary, the others approximate in distant groups of 2—4 on each side of the rhachis; are very narrowly lanceolate; gradually taper above to a slightly asymmetrical acuminate point, the lower margin of which terminates 2—3 cm. below the tip in a small spinule, at times however obsolete; otherwise the margins are smooth and slightly thickened; the intermediate leaflets, the largest, are 35—40 cm. long, 3 cm. wide. One of the uppermost leaves bearing at its axilla a branch of the inflorescence, is rather large, has the leaf-sheath slightly spinous on the dorsum and on the margins near the mouth; the petiolar part is 10 cm. long, and 2 cm. wide, the rhachis is robust and in the intermediate portion obsoletely angular, powerfully armed with 3—5-nate claws; the leaflets are very unequidistant, and scattered, not very distinctly grouped, very elongate, ensiform, very gradually acuminate to a very finely subulate tip; are thickly papyraceous, though, green above, rather more or less distinctly rusty-furfuraceous beneath; the margins smooth, thickened, the secondary nerves rather prominent; the intermediate leaflets are 50—55 cm. long, 2 cm. wide, the lower are narrower. *Male spadix* . . . . *Female spadix* as usual composed of several branches or partial inflorescences each issuing from the axilla of a leaf gradually reduced, one partial inflorescence, apparently one of the lowest, is composed of 5 very approximate spikes, recurved and pendulous; the spikes have a very short peduncular part, sheathed by some empty spathels and are 60—70 cm. long; their main axis is terete, 5 mm. thick, smooth, very slightly furfuraceous; spathels 15 mm. apart, very concave, broadly rhomboidal, bluntish, 2 cm. long and as wide, broadest about their middle or a little above that; their upper half widely triangular, frequently sharply defined by a projecting tooth on the margin at both sides, thinly coriacious, very rigid, of a very dark chestnut-brown colour, finely striate, quite glabrous, otherwise very similar to those of *Pl. Muellerii*. *Spikelets* very short, bearing only 3—4 pedicellate flowers; the pedicels trigonous, slender, 3—4 mm. long, glabrous; every flower is furnished with a subulate bract, 3—4 mm. long. *Female flowers* 1 cm. long (not taking into account the protruding stigmas); the calyx has a solid, very narrow, trigonus, glabrous, 4 mm. long, pedicelliform basal part and is suddenly expanded above into a limb, parted into 3 ovate, finely striate apiculate lobes; the corolla, slightly longer than the calyx, has a shallow cupular base, but otherwise is almost entirely parted into 3 rigid, triangular-lanceolate acuminate segments; the sterile stamens form with the confluent broadened bases of the filaments a very shallow cup, lining the undivided part of the corolla, and divided into 6 deltoid, suddenly long-subulate teeth, bearing oblong or linear anthers; ovary globular-ovoid, soon becoming broadly turbinate and obsoletely trilobed, covered with scales having a fimbriate-laciniate tip; the stigmas trigonous, subulate, 6 mm. long. *Fruit* . . . .

Habitat.—The Island of Billiton in the Sunda Archipelago, recently discovered by *Dr. Heine* (No. 2425 *bis* fertile specimen and No. 3 sterile specimen in Herb. Bogor. and Beccari).

Observations.—It differs from *P. Muellerii*, which it greatly resembles, in being a more robust plant, with larger leaves and with more numerous leaflets, narrowly lanceolate and very long acuminate, more or less distinctly rusty-furfuraceous beneath, especially in the leaves of young plants, the leaflets of which have also an asymmetrical apex. The female spadix is very similar to that of *P. Muellerii*, but the spathels are more distinctly rhomboidal, quite glabrous, and the flowers are smaller, with the calyx having the limb very suddenly expanded from a very narrow pedicelliform smooth base, and deeply divided into 3 ovate parts, even before the anthesis. In *P. Muellerii* the calyx has at the time of flowering a cup-shaped 3-toothed not split limb, and the corolla slightly longer than the calyx.

Plate 21.—Plectocomia billitonensis *Becc.*—An entire female partial inflorescence with growing ovaries, and intermediate portion of a leaf; from Heine's No. 2425 *bis*. Detached leaflet from a young plant (Heine No. 3).

Latin Diagnosis.—Plectocomia billitonensis *Becc.* sp. nov. Frondium segmentis inaequidistantibus anguste lanceolatis et longe acuminatis, junioribus subtus indumento tenuissimo rubiginoso indutis; spicarum spathellis rhombeis, glabris; floris fœminei calyce parte pedicellari gracili brevi statim in limbum tripartitum expansa, prædito, limbi segmentis ovatis apiculatis; corollæ segmentis acuminatis calycem paullo superantibus.

6. Plectocomia Elmerii Becc. sp. n.

Description.—One of the largest species. *Sheathed* stem about 10 cm. in diameter. (Elmer). *Leaves* very large; rhachis near the base (the only part seen by me) about 3 cm. broad, finely softly grey tomentose, flattish above, slightly convex below and clawed along the middle, the sides for the insertion of the leaflets flat, 6 mm. wide. *Leaflets* in groups, those of the portion just mentioned 55—62 cm. long, 35—42 mm. wide, lanceolate-ensiform, very gradually acuminate above to a rather rigid, very slightly asymmetrical point, the lower margin remaining 3—4 cm. shorter than the upper; in the herbarium specimens the upper surface is green and the lower reddish brown but quite destitute of any kind of indumentum; the margins are distinctly thickened and occasionally provided at very long intervals with a few very small spinules; secondary nerves barely distinguishable from very numerous tertiary ones and giving on the whole a finely striate appearance to both surfaces. *Male spikes* ...... *Female spikes* have spathels very similar to those of *P. Muellerii* and *P. billitonensis*, but larger; one spike is 70 cm. long, inclusive of an arched basal part; its main axis sinuous, subterete, 5 mm. thick, furfuraceous (not scabrid), its internodes 12 mm. long; spathels very concave, broadly rhomboidal, bluntish, 3·5—4 cm. long, and nearly as wide, broadest about their middle or a little above it, the upper half part widely triangular, frequently sharply defined by a projecting tooth on the margin on both sides, thinly coriaceous and very rigid, of a very dark chestnut brown colour, finely striate, quite glabrous. *Spikelets* formed by 5-6 flowers,

borne on very short furfuraceous pedicels ; every flower furnished with a subulate bract 4—6 mm. long. *Female flowers* 18—20 mm. long (not taking into account the protruding stigmas); the calyx has a solid, very narrow, tapering trigonous, glabrous, 8—10 mm. long, pedicelliform part, and is suddenly expanded above into a limb parted into 3 ovate apiculate lobes ; the corolla slightly longer than the calyx, has a shallow cupular base, and is otherwise almost entirely parted into 3 rigid triangular-lanceolate, acuminate segments : the sterile stamens form with the confluent broadened bases of the filaments a shallow cup divided into 6 deltoid, suddenly long-subulate teeth, bearing oblong or linear anthers ; ovary globular-ovoid, strigose ; stigmas trigonous, subulate, 7 mm. long. *Fruit* globose, slightly depressed, 25—27 mm. in diameter, very shortly mammillate and also beaked with the remains of the stigmas and of a general glabrous appearance. The pericarp is very thin and brittle ; the scales are shiny, of a dirty straw colour with darker margins and tips, sharply and narrowly grooved along the centre, the tip somewhat produced, and like the margins, minutely ciliate-fringed. *Seed* globular, somewhat depressed, 15 mm. high, 19—22 mm. broad in one direction, and a few mm. less in the other ; the integument is very scanty, thin and adherent to the nucleus, the surface of which is obsoletely marked by bold ridges, divided by shallow vertical furrows descending from the punctiform apical chalaza ; embryo basal.

Habitat.—The Island of Mindanao. Discovered by *A. D. Elmer* in Sept. 1909 at Todaya (Mt. Apo), District of Davao at about 1000 m. elev. (Elmer No. 11877 in Herb. Becc.).

Observations.—Evidently allied to *P. Muellerii* and *P. billitonensis*, but doubtless distinct, especially by its larger flowers having an extraordinarily long pedicelliform calyx, and by the larger non-hairy fruits. Its diagnostic notes are : The general large size of the plant ; the leaf-rhachis finely grey tomentose ; the leaflets in groups destitute of any kind of indumentum underneath ; the female spadix with broadly rhomboidal glabrous spathels and smooth, slightly furfuraceous main axis ; the female spikelets composed of 4—5 relatively large flowers, having the calyx tapering to a long trigonous narrow base, and expanded above into a 3-parted limb ; the corolla slightly longer than the calyx ; the ovary strigose ; the fruit large, globular depressed, very shortly mammillate and supported by a conspicuous pedicelliform perianth ; the scales sharply grooved, not fimbriate ; the large seed, globular depressed, uneven.

I reproduce here Merrill's field note, which gives additional information about this fine Palm, not obtainable from the herbarium specimens at my disposal :

"Large tree climber in jungles of dense woods on a ridge or along streamlets at 3,000 feet on the Talon side of the mountain range ; old stem yellowish-green or, when young, glaucous-green, terete, hard, smooth, rigid, 2 to 3 inches thick at least ; the leaf bearing portion 4 inches thick at least ; leaves alternatingly scattered, every foot or so, ascendingly recurved, 12 feet long, terminated by at least 7 feet long hooked rhachis ; petiole 2 feet long, glaucous-green along the smooth underside, widely grooved on the upper, provided with yellowish spines along the edges ; leaflets in groups, twisted and ascending from the yellowish bases, strongly recurved, similarly deep green on both sides, tough, not rigid ; rhachis grooved along the upper side, convex beneath, hooked its full length, otherwise smooth ;

sheaths glaucous-green, smooth, except the margins of the V-shaped slit sheath or stipule; infrutescence terminal, smooth, 10 feet long, the lower branches arising from the uppermost smaller leaf-stalks, 3 feet long, few branched and ascending from near the base; the branchlets pendulous, evenly provided with bracts and fruits; fruits flattish-globose 1 inch across."

Native name "Ungang."

PLATE 22.—Plectocomia Elmerii *Becc.*—An entire female spike, and the end of another with flowers; two fruits, and one seed; portion of a leaf from near the base. Elmer's specimen No. 11877 in Herb. Beccari.

LATIN DIAGNOSIS.—Plectocomia Elmerii *Becc* sp. nov.

Grandis, caudice vaginato 10 cm. diam.; frondium segmentis per greges approximatis, utrinque glabris et virentibus; spicarum fœminearum spathis rhombeis, glabris; floribus fœmineis majusculis; calyce parte pedicellari trigona-elongata, basi sensim attenuata, praedito, limbo 3-partito, segmentis acuminatis longitudinem corolla fere aequantibus; fructibus globoso-subdepressis, breviter mammillatis, glabris, squamis nitidis in medio distincte sulcatis et in margine ciliolatis; semine globoso-depresso, superficie inaequali.

7. PLECTOCOMIA HIMALAYANA Griff in Calc. Journ. Nat. Hist. v. 100: Palms Brit. Ind. 108, t. 218; Mart. Hist. Nat. Palm. iii, 129; T. Anders in Journ. Linn. Soc. xi, 12; Hook. f. Fl. Brit. Ind. vi, 478; Brandis, Ind. Trees, 649; Gamble, Man. Ind. Timb. 2nd ed. 737: Darj. List, 87.

P. montana Hook. f. & Thoms. Herb. Ind. Orient.

DESCRIPTION.—A very large and high climbing gregarious palm. *Sheathed stem* of the flowering end as thick as a man's arm; the naked canes as much as 4 cm. in diameter, with internodes about 30 cm. in length. *Leaves* large, those of the adult flowering plant 2—2·5 m. long in the pinniferous part, and terminated by a long powerfully clawed cirrus; the petiolar part almost reduced to nothing, the lowest leaflets being attached just at the mouth of the leaf-sheaths, which are thickly coriaceous or almost woody and provided with obliquely encircling transverse, approximate, interrupted, sinuous, raised ridges, minutely muricate on their crest; in younger leaves the leaf-sheaths gradually pass into a more or less elongate petiole, are finely covered with soft greyish down, are coarsely and closely striate, and have the encircling elevated ridges very regularly crested with pectinate, feeble, brownish, needle-like spines, 15—20 mm. long. The rhachis of the upper leaves of the adult plant is 2 cm. broad at its base, flattish on the upper surface; the sides where the leaflets are inserted are rounded; higher up, the rhachis is biconvex, and from the middle upwards it is armed beneath with, at first, solitary, then with 2—3-nate robust claws, becoming half whorled at regular distances in the cirrus; in leaves of young plants the rhachis is puberulous and armed beneath with claws having a longer tip than usual; the cirrus is slender and

also armed with long-pointed claws. *Leaflets* are very unequidistant, usually in distant pairs or threes on each side of the rhachis (the groups often opposite); are narrowly long-lanceolate, gradually tapering below to an acute base, at times flattened and subansate, and narrowing above to a very acuminate filiform tip, very long and slender in leaves of young plants; are thinly papyraceous, quite glabrous, and almost equally green on both surfaces; have a slender mid-costa and on each side of this 2—3 almost equally strong secondary nerves, so as to give to the blade the appearance of being pluricostulate; the margins are not thickened, but distinctly ciliate-spinulous; the lower and intermediate leaflets are 35—50 cm. long, 3·5—4 cm. wide, the upper ones gradually smaller. The entire *inflorescence* is terminal, pyramidate, in a female plant seen by me more than two meters high, composed of several gradually decreasing partial inflorescences, each issuing erect from the axil of a gradually reduced leaf; are soon arching and bearing one above the other several pendulous spikes. *Spathes* of the main branches tubular-infundibuliform, tomentose in their lower part, obliquely truncate at the mouth, and produced at one side into a triangular acuminate point. *Male spikes* 60—80 cm. long; their main axis very slender, sinuous, terete, finely tomentose, its internodes 15 mm. long; spathels papyraceous, finely pubescent outside, especially in their basal part, oblong-obcuneate, triangular in their upper third or fourth part, acute or acuminate, 4—5·5 cm. long, 2 cm. wide. *Spikelets* about half as long as the spathels, their axis slender, angular, fulvous-tomentose; flower-bracts very minute, subulate. *Male flowers* geminate on notches of the axis of the spikelets, lanceolate, acuminate, 7—8 mm. long; the calyx shallow, cupular, trigonous, or with 3 triangular subulate teeth, the margin glabrous; petals several times longer than the calyx, lanceolate with acuminate wavy points; stamens having subulate filaments with thickened bases; anthers broadly linear, slightly sagittate, obtuse, punctulate, 4 mm. long; rudimentary ovary represented by 3 very small round papillæ. *Female spikes* 45—60 cm. long, having a pedicellar part 6—8 cm. long, attached to the bottom of their respective spathes, and sheathed by only one tubular-infundibuliform non-spikelet-bearing spathel, quite different from the succeeding spathels, all of which are spicigerous and identical with those of the male spikes, but of a firmer texture; the main axis of the spikes slightly sinuous, clothed with a thin soft, adherent, tobacco coloured tomentum; its internodes 15 mm. long, 3—4 mm. thick, slightly clavate, flattish on the axial side. *Spikelets* subscorpioid with 5—9 flowers subunilaterally biseriate on the deep notches of the axis; floral bracts very small, triangular subulate. *Female flowers* about as long as the largest male ones (8—9 mm. long but considerably broader (6 mm. broad at the base); the calyx very shallowly cupular, trigonous, 3-toothed, of a scarious texture, the teeth long-acuminate-subulate; the corolla has a very short shallow concave entire base, but otherwise is parted into 3 triangular acuminate segments; the sterile stamens form with the confluent broadened bases of the filaments a very shallow cup, divided into 6 deltoid subulate teeth, bearing conspicuous sagittate anthers; ovary globose, strigose; stigmas sessile, trigonous, subulate. *Fruit* globular, 15 mm. in diameter, rounded above, and crowned by the small remnants of the stigmas; scales very small, in very numerous longitudinal series, yellowish brown with shiny blackish, toothed-papillose (or glandular?) margins, nearly flat, slightly squarrose. *Seed*

orbicular-depressed, 1 cm. in diameter, 6 mm. high. *Fruiting perianth* 15 mm. across between the apices of the segments of the corolla; the calyx half as long as the corolla, more or less 3-lobed, being split in the sinuses.

HABITAT.—Sikkim Himalaya, especially abundant in the Darjeeling District from 1200 to 2000 m. elevation. (*Griffith*, Herb. East India Comp. No. 6424 in Herb. Kew); Hook, f. & Thomson exsiccata (*P. montana*) in fruit; and several other collectors.) Vern. n. "Tahri Bet" (Nep.); "Ranul, Runul, Ranol" (Lepcha). It produces soft canes of very little use except occasionally for tying fences, and for rough basket work (Gamble). In fact the cortical part of the stem of this Palm is not so strongly silicified as that of the more useful Rinds of Rattan canes.

OBSERVATIONS.—I have seen of this species the entire upper part of a flowering female plant, kindly forwarded to me from Darjeeling by Sir David Prain; with this material I have been able to give an almost complete description of this palm. Its main diagnostic notes are: The sheaths furnished with raised muricate or spinous ridges; the leaves with leaflets green on both surfaces ending in filamentose tips; the spikes with only one vacuous spathel at its base, and with the axial parts softly tomentose; the spathels oblong, twice as long as broad, finely tomentose outside; the male flowers sessile with short shallow glabrous trigonous calyx; the female flowers with shallow cupular thinly cartilaginous trigonous calyx, and the corolla twice as long as the calyx; the ovary with strigose non-laciniate scales, the stigmas sessile subulate; the fruit globular, relatively small, not woolly; the scales with toothed-papillose margins and obtuse tips, the latter appressed or very slightly squarrose; the seed orbicular-depressed; the fruiting perianth quite explanate.

PLATE 23.—Plectocomia himalayana *Griff.*—Portion of a partial inflorescence with not quite mature fruits, from a specimen collected in Sikkim by Sir D. Prain in 1902. Two mature fruits and one seed (chalazal side) from Tukdah in Darjeelling (Gamble). Upper part of a leaf sheath and intermediate portion of a leaf from a young plant collected in the Darjeeling District by Brandis.

8. PLECTOCOMIA ASSAMICA.—Griff in Calc. Journ. Nat. Hist. v, 97: Palms Brit. Ind. 107, t. 218 a a; Mart. Hist. Nat. Palm, iii, 199, t. 166, f. xii; Hook. f. Fl. Brit. Ind. vi, 479; Brandis, Ind. Trees, 650; Gamble, Man. Ind. Timb. 2nd ed. 737.

Zalacca? assamica Lodd. ex Miq. Fl. Ind. Bat. iii, 81.

DESCRIPTION.—*Leaves* (not seen by me) very large; leaflets white and finely furfuraceous beneath. 45—60 cm. long, 6—6·5 cm. wide, tip not thread-like, costæ slender; petiole nearly 4 cm. broad, with stout marginal spines and short seriate scattered clusters of more slender dorsal ones (Descr. from Hooker l.c.). *Male spikes* . . . . *Female spikes* 70 cm. to 1 m. and over in length; the main axis slightly sinuous, clothed with adherent soft thin rusty tomentum; the internodes 2—2·5 cm. long, slightly clavate, subterete or obsoletely angular. *Spathels* as usual distichous, cuneate-oblong, more than twice as long as broad (6—7 cm.

long; 2·5—3 cm. wide), subtruncate or abruptly terminated by a broad and low, triangular, acute or bluntish point; their broadest part is 15—20 mm. only below the apex, and thence slightly tapers to a rather broad, concave, amplectent base; are thinly coriaceous, clothed outside from the base with a fine rusty tomentum, evanescent only in the upper triangular part. *Spikelets* composed of 3—7 flowers, on the whole shorter than their respective spathels, the flowers are alternately distichous on a thickish angular, 15—25 mm. long axis, and are supported by 3—4 mm. long, thick, subclavate, trigonous pedicels; the axis and the pedicels rusty furfuraceous; the bracteole at the base of every flower lanceolate—acuminate. recurved, 4—5 mm. long. *Fruit* globular, 23—25 mm. in diameter slightly conically beaked from the persistent broadened bases of the stigmas, of a rich ferrugineous-brown colour when dry, densely villous or woolly from the deeply ciliate-split, recurved, frizzled points of the scales. *Seed* globular (18 mm. in diameter in Griffith's figure). *Fruiting perianth* explanate; the calyx splits into 3 ovate oblong parts; petals acuminate, considerably longer than the calyx and narrower than its divisions (in Griffith's figure).

HABITAT.—Upper Assam (*Griffith*).

OBSERVATIONS.—The original specimens upon which Griffith established this species still exist in the Calcutta Herbarium, and consist in some spikes having the spathels "much lacerated and split and partly deficient" as Griffith says, and fragments of one fruit; these specimens are accompanied by the following label:—From Upper Assam. Rec. from Capt. Jenkins, 11 March 1840.—I have based my description on these specimens; but in the Calcutta Herbarium are preserved other specimens, corresponding pretty well to the typical ones, but apparently gathered from plants that had flowered in the Garden, consisting of some spikes of a female spadix bearing flowers just at the moment of their expansion; these flowers are 2 cm. long and about 1 cm. broad at their base; the calyx is at first cupular-campanulate, rounded and not thickened at the base, striately veined, slightly furfuraceous, ciliolate on the margins and having 3 broadly triangular subulate teeth; later it splits into 3 very broad segments, suddenly contracted into a finely subulate tip, 8 mm. long including the tip; the corolla is much longer than the caylx, at least twice and half as long; the petals from a broad base are narrowly lanceolate-subulate; the ovary is coarsely woolly from the crisp laciniate points of the scales; the style is very short, conical; the stigmas are trigonous, connivent, subulate, 1 cm. long and shorter than the petals during the anthesis.

Although imperfectly known *P. assamica* is well characterized by its leaflets whitish beneath; by the axial parts of the spikes and spikelets covered with intensely rusty tomentum; by the spathels finely tomentose outside, cuneate-oblong, more than twice as long as broad, terminated by a short triangular point; by the female spikelets bearing few flowers, and these on short pedicels, and provided with small bracteoles; by the female flowers having the petals much larger than the divisions of the calyx; and by the fruit globular, slightly conically-beaked and densely villous from scales with crisp tips.

T. Anderson in his Enumeration of the Palms of Sikkim (Journ. of the Linn. Soc. xi, 1869, p. 12) asserts that *P. assamica* and *P. khasyana* are identical (see my observations to *P. khasyana*).

PLATE 24.—Plectocomica assamica *Griff.*—A branch of the spadix with two female spikes in flower. and two detached flowers ; from the supposed cultivated specimens of the Calcutta Herbarium.

9. PLECTOCOMIA BRACTEALIS Becc. n. sp.

DESCRIPTION.—The description of this species is based solely upon some spikes with female flowers in the Calcutta Herbarium, which might easily be mistaken for those belonging to *P. assamica*, but for their uncommonly large floral bracts. In the new species the female spikelets have usually 5 flowers, with pedicels 5—6 mm. long, each provided with a lanceolate, long acuminate bract, 10—15 mm. long and tomentose outside. The *female flowers* have the calyx split to the base (often irregularly) into 2—3 elongate-triangular, very acuminate sepals, finely striately veined and puberulous outside, 10—13 mm. long ; the petals from a broad base are lanceolate, very acuminate, 15—18 mm. long ; the ovary is coarsely woolly from the crisp laciniate points of the scales, the style is very short, conical, and trigonous with connivent, subulate stigmas, not surpassing the sepals in length during the anthesis ; the staminodes have very narrowly-sagittate sterile anthers. The *spathels* are larger than those of *P. assamica*, 7—7·5 cm. long, 3 cm. wide, but of exactly the same shape, and like them are clothed with a thin soft indumentum ; the axis of the spike is also rusty tomentose, the internodes are slightly clavate, 2—2·5 cm. long, 5—6 mm. thick.

HABITAT.—Upper Assam ; at least this is the locality given upon the label attached to the specimen preserved in the Herbarium at Calcutta ; but probably this specimen is from a plant once cultivated in that garden. The label bears printed : "Coll. Masters", but this name has been intentionally struck out. A similar specimen exists in the Herbarium at Petrograd.

OBSERVATIONS.—Apparently very similar in general habit to *P. assamica*, but as far as it can be judged from the very incomplete specimens available it is at once distinguishable by the more distinctly pedicellate flowers and their very conspicuous long bracts (in *P. assamica* only 4—5 cm. long), but especially by the female flowers having the calyx split from the base into triangular acuminate segments, only a little shorter than the petals. Judging from the ovary, the fruit has probably the same woolly appearance as that of *P. assamica.*

PLATE 25.—Plectocomia bractealis *Becc.*—The entire type specimen, and detached flowers, in the Herbarium at Calcutta.

LATIN DIAGNOSIS.—Plectocomia bractealis *Becc.* sp. nov.

Floribus fœmineis longiuscule pedicellatis, calyce fere usque ad basin tripartito segmentis triangularibus, acuminatis, longitudinem petalorum fere aequantibus ; bracteolis floralibus conspicuis, lanceolatis, longe acuminatis et 10—15 mm. longis ; ovarii squamis lanato-crispis.

10. PLECTOCOMIA KHASYANA Grifi. in Calc. Journ. Nat. Hist. v, 106 : Palms Brit. Indi 106, t. ccxviii ; Hook. f. Fl. Brit. Ind. vi, 478 ; Brandis, Ind. Trees, 650 ; Gamble, Man. Ind. Timb. 2nd ed, 737. *P. assamica* (non Griff.) W. Hooker in Bot. Magaz. t. 5105, f. 1—5 (excl. fig. 6—10).

DESCRIPTION.—*Stems* 18—25 m. long, as thick as a man's arm (Brandis). *Leaves* very large. *Leaflets* broadly lanceolate, or lanceolate-elliptical, their broadest part being in the middle, and thence equally tapering to both ends, gradually but not very long-acuminate above, conspicuously discolorous, *i.e.*, green above and mealy whitish beneath; the mid-costa stronger on the lower than on the upper surface, the nerve on each margin as strong as the mid-costa; secondary nerves numerous, very slender; the margins appressedly minutely spinulous from the middle upwards; intermediate leaflets 40—42 cm., and in young specimens in cirriferous leaves up to 60 cm. long and 8 cm. wide; the apex slightly falcate. *Male spikes* 45—60 cm. long, their main axis slender, lanuginose; the internodes 15—20 mm. long. Spathels 5—6 cm. in length, oblong, triangular in their upper third part, and thence slightly tapering downward, the apex acute or bluntish, the margins ciliolate, the outer surface greyish tomentose in their lower two-thirds, glabrous above. *Male spikelets* 2—2·5 cm. long and having many flowers; their axis fugaciously lanuginose; bracteoles very small subulate. *Male flowers* 10—12 mm. long, sessile, narrowly lanceolate-subulate; the calyx quite glabrous, very small and shallow, trigonous, 3-toothed, 2 mm. across, the teeth very acuminate; petals cartilaginous, lanceolate, gradually acuminate from the base, the points more or less wavy; stamens with thickish and subulate filaments; anthers elongate-sagittate, acute, 3 mm. long; rudimentary ovary very small. *Female spikes* . . . . *Fruit* (description after Griffith) "surrounded at the base by the calyx and corolla, not flattened out, apex attenuated into the style, rostrate-apiculate, otherwise round, about one inch in diameter (25 mm. in Griffith's figure) dark brown; scales very numerous, rather small, either nearly smooth or with ciliate margins, and recurved, split, fimbriate points; when not much rubbed it has a woolly appearance." *Seed* globular, slightly depressed, 18 mm. broad, 15 mm. high in Griffith's figure.

HABITAT.—Khasia Hills: (*Griffith*; *Hook.* f. *& Thomson* exsicc.); at Shaila 750 m. alt. (*Brandis* in Herb. Becc.—Leaves only.)

OBSERVATIONS.—I have a very incomplete knowledge of this species, which T. Anderson (Journ. Linn. Soc. xi, 12) declares identical with *P. assamica*, from which, however, it seems to differ especially in the fruit distinctly beaked, not woolly, having the scales simply fimbriate and not crisped. The fresh spathels of *P. khasyana* are described by Hooker as white with broad acute or acuminate tips and with a broad brown interposed band; in *P. assamica* the spathels appear more densely tomentose.

I have described the male spike and flowers from the plant that flowered at Kew and was figured in the Botanical Magazine.

PLATE 26.—Plectocomia khasyana *Griff.*—An entire partial male inflorescence from the plant that flowered at Kew. (Reproduction of the sheet in the Herbarium at Kew.)

11. PLECTOCOMIA KERRANA Becc. sp. n.

DESCRIPTION.—Apparently a smaller plant than *P. assamica* and *P. khasyana*. *Leaves* 2·40 to 2·70 m. long (Kerr), inclusive of the terminal cirrus. The rhachis

in a portion near the base (2 cm. broad) is convex beneath and provided with distant solitary claws along the dorsum and with some small spines at the sides; it is broadly channelled above, has rounded margins, upon which are attached the leaflets, and is subterete towards the end; the cirrus in one leaf (probably from the upper part of the plant) is robust and short (35 cm. long), very closely and regularly armed with half whorls of 5-nate claws, with pale swollen bases and short blackish points. *Leaflets* in groups of 2—4 in the lower part of the rhachis, and distantly scattered towards the end, conspicuously discolorous, green above, white puberulos beneath; the marginant nerves stronger than the mid-costa; the margins remotely and very minutely spinulous; the lower leaflets are lanceolate, 55 cm. long and 5 cm. wide in their lower third part, and thence very gradually acuminate upwards to a subulate rather rigid tip; upper leaflets gradually and considerably smaller and broadest about their middle. The uppermost leaves, from the axillas of which spring the branches of the spadix, are reduced to a clawed cirrus only, terminating the sheath; the latter is covered with greyish down and armed with small pale, often fascicled, slender spines. *Male spikes* are recurved, from an ascendent, rather elongate, peduncular part, are 75—90 cm. long, terete, and about 1 cm. in diameter before the anthesis; at that moment the spathels are appressedly imbricate, but become spreading later, are quite glabrous, green and glaucous outside in their upper half, which remains exposed before the anthesis, and paler in the lower and covered part; are cinnamon brown inside (in the dry condition), and very finely striate on both surfaces, are of a thin rigid papery texture, cuneately oblong, broadly triangular in their upper third part, and thence tapering to a narrow base; the apex is acute; the lower spathels are 4·5 cm. long, 2·5 cm. wide; the upper gradually slightly smaller. The main axis of the spikes is slightly zig-zag sinuous, subterete, 2 mm. in diameter in its lower thickest part, scabridulous from short rigid branched rusty hairs; the internodes are 15—20 mm. long. *Male spikelets* 3·5 cm. long in the lower part of the spikes, shorter above, very densely flowered, their axis covered with coarse pale branched hairs. *Male flowers* lanceolate, very acuminate, 1 cm. long, in very approximate pairs, provided with short scarious, brown, broad, acute, spreading bracts and bracteoles; the calyx quite glabrous, very small, trigonous 3-toothed, 2—2·5 cm. across; its teeth acuminate; petals thinly cartilaginous, lanceolate, acuminate from the base, the points more or less wavy; stamens with stoutish subulate filaments; anthers elongate-sagittate, 4 mm. long, acute; rudimentary ovary very minute. *Female spikes* having the main axis thicker than that of the male ones, rusty-scabrid and 5 mm. in diameter; the spathels are as in the male spikes, much lacerated at the fruiting time. *Spikelets* 2—2·5 cm. long, having 8—10 alternate flowers borne by very short thick trigonous rusty-scabrid pedicels; the floral bracts very small. *Fruits* are spherical or a little longer than broad, 23 mm. in diameter, very slightly mammillate, and beaked by the remains of the persistent short, trigonous, connivent stigmas and are of a general smooth appearance; the scales are arranged in very numerous (nearly 50) longitudinal series, flattish and faintly grooved along the centre, polished, of a deep straw colour, with narrow reddish-brown edges; the margins very minutely and densely ciliate; the apex very slightly produced, bluntish, very minutely ciliate-fringed and very slightly raised (not applied) rendering the fruit faintly squarrose. *Seed* exactly spherical, 15 mm. in diameter. *Fruiting perianth*

not accrescent, quite explanate and sessile on its pedicel ; the calyx very small, 5 mm. across, with 3 deltoid acute or acuminate teeth ; the petals striately veined, anceolate-acuminate, slightly falcate, several times longer than the calyx, 12—13 mm. long, 3—4 mm. wide at the base ; the sterile stamens form a flat stellate disk, with 6 deltoid teeth, subulate at apex and bearing small sagittate anthers.

Habitat.—North-West Siam, discovered by Dr. *A. F. G. Kerr*, the 30th April 1911, at Doi Soetep near Chiengmai at 1,200 m. elev., in dense evergreen jungle ; No. 1817 in Kew and Beccari Herbaria.

Observations.—Allied to *P. Pierreana* Becc. and perhaps like that derived from *P. khasyana* Griff. It is characterized by the conspicuously discolorous leaflets, puberulous-white beneath ; by the spathels glabrous glaucous in their upper half ; by the male spikelets being very densely flowered ; by the male flowers having very small trigonous 3-toothed, quite glabrous calyces ; by the fruit being obsoletely mammillate, not woolly, but very slightly squarrose, having the scales with short ciliate points ; by the fruiting perianth having the calyx explanate and split, but trigonous and 3-toothed ; and by the petals narrowly lanceolate-acuminate and falcate, several times longer than the calyx.

P. kerrana differs from *P. Pierreana* in its larger slightly mammillate fruit, having an exactly spherical seed, and being covered by scales with bluntish not produced apices, and in the fruiting perianth having the calyx not split, smaller and with much longer and more acuminate petals.

From *P. khasyana* it differs in the quite glabrous (not externally pubescent) spathels, and in the axes of the spikes being rusty scabrid.

Plate 27.—Plectocomia Kerrana *Becc.*—Portion of the upper part of a flowering male plant with a spike before the anthesis. Male spike in flower ; the end of a leaf. From Kerr's No. 1814, in Herb. Becc.

Plate 28.—Plectocomia Kerrana *Becc.*—Spike with mature fruits ; detached fruits ; seed cut through the embryo ; intermediate portion of a leaf. From Kerr's No. 1814 in Herb. Becc.

Latin diagnosis.—Plectocomia Kerrana *Becc.* sp. nov. Frondium segmentis conspicue discoloribus, supra virentibus, subtus indumento tenui, puberulo, albido, indutis ; spicarum parte axili scabrida ; spathellis glabris in dimidia superiori parte glaucis ; floris ♂ calyce parvo, trigono, tridentato, omnino glabro ; fructibus sphaericis, majusculis, obsolete mammillatis, sub-squarrosis, squamis apice breviter ciliatis ; semine sphaerico ; perianthio fructifero explanato, petalis anguste lanceolato-falcatis quam calyce pluries longioribus.

12. Plectocomia Pierreana Becc. in Webbia, iii (1910), 236, 244, and in Bull. Mus. d'Hist. Nat. Paris, 1911, No. 3, 158.

Description.—Apparently one of the smaller species of the genus. The *leaves* that are known with certainty to belong to it are only those very near the flowering end of the plant, placed immediately below the inflorescence ; such leaves have the leaf-sheath about 2 cm. in diameter, sprinkled with small very short spines especially abundant along the dorsum and near the margins of the mouth ; the

petiole is reduced almost to nothing; the pinniferous part is very short, the rhachis is unarmed on both surfaces, subterete, slightly and narrowly grooved on the upper surface. *Leaflets* not numerous, approximate in pairs or in threes on each side of the rhachis, very narrowly lanceolate, 15—25 cm. long, 12—18 mm. at their widest, narrowing below to an acute base and very gradually upwards to a slender very acuminate tip, rigid, papyraceous, slightly paler underneath than above, with the mid-costa prominent only near the base, and the margins more or less thickened. *Male spadix* . . . . *Female spadix* as usual branched; one branch issuing from a leaf is at first erect and is divided at different levels into 3 spikes, pendulous from a rather elongate curved basilar part, which is sheathed by several spathels not bearing spikelets; the lowest of these spathes is elongately tubular, the following are obconical and obliquely truncate at their mouths; the flower-bearing portion of the spike is, in two specimens, 35 cm. long; its main axis is slightly sinuous, obsoletely-trigonous, rusty-furfuraceous; the spathels are 12—16 mm. apart, 3 cm. long, 2 cm. wide, obovoid-oblong, with their upper part broadly triangular from a little above the middle, acute at apex, thinly papery, very finely striate on both surfaces, apparently glabrous externally (I have seen only those of the fruiting spadices, much deteriorated by age). *Fruit* spherical, 2 cm. in diameter, abruptly beaked from the remains of the stigmas, of a slightly squarrose and not woolly appearance; scales arranged in 42—44 vertical series, rather glossy, of a deep straw, or reddish brown colour with either darker or chestnut brown margins, their points triangular, somewhat produced or acuminate and, like the margins, very finely ciliate fringed; the scales of the upper half of the fruit applied; those of the lower half very slightly raised. *Seed* globular, somewhat depressed, *i.e.*, slightly broader than high, 14—15 mm. broad, 11—11·5 mm. high; its surface even but rendered rough from the thin, very adherent, dry integument; raphe indistinct; chalazal fovea inconspicuous, punctiform, quite superficial; albumen bony, homogenous; embryo basal. *Fruiting perianth* quite explanate and sessile on its pedicel; the calyx small 7—8 mm. across, with 3 deltoid acute or acuminate teeth, usually split in the sinuses; the petals lanceolate with more or less falcate acuminate points, about 1 cm. long, 3—3·5 mm. wide at the base, three times as long as the calyx; the sterile stamens form with the confluent broadened bases of the filaments a flat stellate disk divided into 6 deltoid subulate teeth, bearing small sterile, sagittate, distinctly biauricled anthers.

HABITAT.—Indo-China: On the mountains of Cam-chây at 900 m. elevation in the Province of Kampuh in Cambodia (*Pierre* No. 4857 in the Paris Herbarium and from the same source, Herb. Hance No. 19241 in the British Museum Herbarium).

OBSERVATIONS.—It is perhaps the smallest species of the genus, closely related to *P. Kerrana*, and apparently derived from *P. khasyana*. It is characterized by the leaflets being paler beneath than above (not mealy or powdery white beneath); by the spathels being glabrous, obovoid-oblong, about twice as long as broad; by the female spikes having a rusty furfuraceous axis; by the fruit being not wooly but slightly squarrose, exactly spherical, covered by scales having finely ciliate margins, and slightly produced, acuminate, minutely ciliate fringed points; by the globular seed slightly broader than high; and by the explanate fruiting perianth with trigonous, 3-toothed calyx, and the corolla three times as long as the calyx.

From *P. Kerrana* it differs in the smaller exactly spherical fruit, in the seed broader than high, in the smaller fruiting perianth, with relatively larger calyx and shorter petals.

Most probably belongs to *P. Pierreana* one sterile specimen consisting of a portion of a leaf from an adult but not yet flowering plant, collected also by Pierre in Cambodia on the mountains Panghi at 300 m. elev. Province of Binh Thuan (Pierre No. 4856 in the Paris Herbarium.) Annamite name "May-xuong-móc." In this specimen the rhachis is subterete, armed below along the middle with solitary or 2—3-nate claws ; the leaflets are ashy-gray beneath, lanceolate, very acuminate, thinly papery, 60—70 cm. long, 4—7 cm. wide, with the margins strongly thickened and spinulous near the apex.

PLATE 29.—Plectocomia Pierreana *Becc.* One leaf (wanting the terminal cirrus) apparently from the upper flowering part of the plant ; fruits and seeds. From Pierre's specimen in the British Museum Herbarium.

PLECTOCOMIOPSIS Becc.

Becc. in Hook. f. Fl. Brit. Ind. vi, 479; Ridley, Mat. Fl. Mal. Penins. ii, 213 (partly).

Large, scandent, calamoid, dioecious, monocarpic palms, with terminal inflorescence formed by several branches each issuing from the leaf-sheath of a reduced leaf. *Leaves* of the adult plant cirriferous, having leaf-sheaths not gibbous above and gradually passing into the petiole; the mouth provided with a fugacious ocreiform membranous appendage. *Leaflets* elongate, acuminate, straight, unicostate, sprinkled with microlepidia on the under surface; margins not or slightly thickened; secondary nerves slender. *Male* and *female* partial inflorescences twice branched. *Male flowering-branchelets* elongate, bearing distichally several small few-flowered spikelets. *Male flowers* having thick filaments united together in their basal part, and introflexed at the apex; anthers dorsifixed, dehiscing laterally; rudiments of the ovary very small or obsolete. *Female spadix* having the flower-bearing branchlets elongate, bearing distichally and alternately greatly reduced spikelets, composed of only two (rarely 3—4) female flowers, not accompanied by a male or neuter flower, and provided with only one disciform involucre. *Female flowers* of a thickish structure; the calyx cupular-campanulate, 3-toothed; the corolla undivided and urceolate in the basal part, and more or less 3-lobed or 3-parted above stamens; with filaments united together to form a membranous tube more or less connate with the corolla, 6-toothed in the free part and bearing anthers apparently well conformed. Ovary oblong, obsoletely trilocular, 3-ovulate, the dissepiments of the cells soon obliterated; stigmas short, thick. *Fruit* monospermous, globose, the pericarp fragile, covered with scales arranged very regularly in very numerous series. *Seed* globular, covered with a rather thick fleshy integument; the nucleus not pitted; albumen equable; embryo basal.

OBSERVATIONS.—*Plectocomiopsis* is allied to *Myrialepis*, from which it differs especially in the fruit, (which in *Myrialepis* is covered with very irregularly arranged extremely minute scales) and in the different conformation of the female flowers. Likewise *Plectocomiopsis* much resembles *Plectocomia* in the vegetative organs, but the spadices and the flowers, male and female, are widely different in the two genera.

Only two species belong with certainty to the genus *Plectocomiopsis*, *P. geminiflorus* and *P. Wrayii*, *P. dubius* being a doubtful species. Of the other two species I have included in the genus *Plectocomiopsis* (*P. paradoxus* and *P. floribundus*), the male plant only is known, and in the absence of the female spadix and fruit, their generic positions remain somewhat uncertain, the more that they show also marked affinities with *Myrialepis*.

The stem of *P. geminiflorus*, and perhaps also of the other species of the same genus, is distinctly 3-gonous when the plants are young, but the tendency of the stem

to keep that shape remains also to the last period of the life of the plant, in its uppermost flowering end. A trigonous stem is a structure of very rare occurrence in palms, only another case approaching that of *Plectocomiopsis* having been observed by me in a spadix-bearing specimen of the African *Eremospatha macrocarpa* Wendl.

GEOGRAPHICAL DISTRIBUTION.—*Plectocomiopsis geminiflorus* has a relatively wide distribution, being found growing from Lower Burma down throughout the entire Malay Peninsula and in Sumatra; it is also represented by local varieties in Billiton and Borneo. *P. Wrayii* and *P. dubius* are restricted to the Malay Peninsula. *P. floribundus* is a Cochin-Chinese species, related however to *P. pradoxus* growing in Pegu.

PLECTOCOMIOPSIS.

KEY TO THE SPECIES.

A. *Flowers* (♂ *and* ♀) *subcoriaceous.*

* Leaves of the upper part of the plant having a very short petiole. Male flowers globose-ovoid. Female flowers broadly ovoid and obtusely trigonous, bluntish. Fruit with scales in 35 vertical series . . .

P. geminiflorus Becc.

† Leaflets having the mid-costa smooth or with a few rigid subspiny bristles. Partial ♀ inflorescences composed of not many thick branches furnished with flowers from near the base. The corolla of the female flower covered with thickish hairs.

1. P. geminiflorus Becc. (forma typica). Lower Burma, Malay Peninsula—Sumatra.

†† Leaflets with long bristles on the mid-costa. Flowering branchlets more slender than in type. Flowers as in type.

P. geminiflorus VAR. **billitonensis** Becc. —Billiton.

††† Leaflets with long bristles on the mid-costa. Partial ♀ inflorescences with numerous branches having an elongate pedicellar part devoid of flowers. Female flowers having the corolla covered with small pellucid scales.

P. geminiflorus VAR. **borneensis** Becc. —Borneo.

** Leaves of the upper part of the plant having a long petiole. Male flowers narrow, clavate. Female flowers narrowly elliptical, acuminate. Fruit with scales in 24 vertical series.

2. P. Wrayii Becc.—Malay Peninsula.

*** Leaves of the upper part of the plant having a long petiole. Male spadix with numerous slender pendulous branches. Male flowers very small, ovate, acute.

3. P. dubius Becc.—Malay Peninsula.

B. Male flowers having membranous calyx and cartilaginous corolla. Male spadices forming large panicles with divaricate branches and scorpioid spikelets. Leaflets with smooth nerves. (Fruit unknown.)

* Leaflets unequidistant but not distinctly grouped. Male flowers 5 mm. long.

4. P. paradoxus Becc.—Pegu.

** Leaflets in small groups with long vacant spaces interposed. Male flowers 3 mm. long.

5. P. floribundus Becc.—Indo-China.

DESCRIPTION OF PLATE II A.

Figs. 1—8. Plectocomiopsis geminiflorus *Becc.*—Fig. 1. Portion of a male flower bearing branchlet with not fully developed flowers.—Fig. 2. Section of a male flower showing the androecium entire.—Fig. 3. Section of a male flower through the middle of the androecium.—Fig. 5. Section of a female flower showing the staminal urceolum (including the ovary) entire.—Fig. 6. The same as fig. 5, but with the urceolum cut through the middle, showing the ovary entire.—Fig. 7—8 Anthers of the female flower, front and back view. All figures enlarged.

Figs. 9—14. Plectocomiopsis Wrayii *Becc.*—Fig. 9. Male flower.—Fig. 10. Female flower.—Fig. 11. Section of a female flower showing the ovary entire.—Fig. 12. Longitudinal section of a male flower.—Fig. 13—14. Anthers from a male flower, back and side view. All figures enlarged.

Figs. 15—21. Plectocomiopsis paradoxus *Becc.*—Fig. 15—17. Male flowers.—Fig. 18. Longitudinal section of the corolla and androecium.—Fig. 19. Back view of half androecium.—Figs. 20—21. Stamens. All figures enlarged 6 diameters.

1. PLECTOCOMIOPSIS GEMINIFLORUS Becc. in Hook. f. Fl. Brit. Ind. vi, 479.

Calamus geminiflorus Griff. ex Mart. Hist. Nat. Palm. iii, 338 ; Griff. Palms Brit. Ind. 70, t. 199 A.

Plectocomia geminiflora H. Wendl. ex Hook. f. l. c.

Calamus turbinatus Ridley, Mat. Fl. Mal. Penins. ii, 212 !

DESCRIPTION.—A strong climber. *Sheathed stem* of the upper part of the flowering plant 3—4 cm. in diameter, terete or nearly so, in young plants more or less trigonous. *Leaf-sheaths* obliquely truncate and with thin dry lacerated borders at the mouth, light straw coloured when dry, glabrescent or very slightly scurfy, sprinkled with scattered conical spines, usually very short or also tuberculiform, but at times (apparently in middle aged vigorous plants) very unequal,

pale, laminar, subulate, up to 2 cm. long and irregularly set in small interrupted series. Intermediate *leaves* about 2 m. long, having a short petiolar part (reduced to nothing in the uppermost leaves) glabrescent or slightly scurfy, 10—13 mm. broad, flattish, slightly furrowed along the centre above, convex and sparingly clawed along the centre beneath; the edges acute and with few distant prickles; rhachis concave above in its lower portion, but with a salient smooth angle upwards, and on the whole trigonous in transverse section, armed below with distant at first single, higher up geminate and finally ternate claws; the cirrus is elongate and armed at regular intervals with half whorled claws. *Leaflets* numerous, equidistant, 4—6 cm. apart, (at times more) on each side of the rhachis, firmly papyraceous, lanceolate, largest about their middle, and thence, gradually and almost equally narrowing towards both ends, the base acute, gradually acuminate from above the middle upwards to a very finely subulate, very slightly bristly tip, glossy above and slightly paler on the undersurface, which also is closely sprinkled with very minute pale dots (microlepidia), visible only under a lens; the mid-costa slender, smooth or occasionally furnished with a few rigid subspiny bristles; secondary nerves numerous on each side of the mid-costa, unequal and connected by sharp transverse veinlets; margins acute or slightly thickened, smooth or very sparingly and remotely spinulous; the intermediate leaflets 25—30 cm. long, 2·5—3·5 cm. broad; upper leaflets gradually diminished till the terminal leaves are reduced to almost only the sheaths and the rhachis, bearing very few and very narrow leaflets, and terminating in a slender clawed gradually shorter cirrus. *Male spadix* apparently more diffuse than the female; a partial inflorescence, probably not entire, is 50 cm. long, and in every part of a uniform fulvous tint; its main axis is 8 mm. thick at its base, narrows above and carries numerous flower-bearing branchlets, all turned to one side; the spathes are tubular-infundibuliform, closely sheathing, obliquely truncate and ciliate at the mouth, and produced at one side into a triangular acuminate point, are finely striate and thinly covered with appressed whitish scales. The flower-bearing branchlets are inserted nearly at the bottom of their relative spathe with a flattened pedicellar part, are considerably thinner than the female branchlets, 20—25 cm. long, flaccid, nodding or pendulous, distinctly zig-zag sinuous between the spikelets or glomerules of flowers; their spathes are infundibuliform with a narrow base and a wide truncate ciliate mouth, produced at one side into a triangular acuminate point, and densely covered with short fulvous hairs. The *spikelets* are reduced to glomerules composed of 5—7 flowers in all, disposed in two series; spathels bracteiform, acute, slightly concave with a broad base, membranous, striate, ciliate; involucre slightly concave, more or less distinctly 3-toothed and striately veined. *Male flowers* globose-ovoid, 4 mm. long, very obsoletely 3-gonous, with a broad base and an obscurely pyramidate point; the calyx subcoriaceous, thickish, glabrous, shortly and broadly 3-toothed, not or only very faintly striately-veined; the corolla broadly ovoid; petals cartilaginous, ovate-elliptical, acute; stamens 6, having the filaments united in their lower part and forming there a small fleshy cup, each filament having however a short and thick free part, which in 3 stamens is slightly longer than in the other 3; anthers broadly ovate, blunt, the cells opening laterally. Rudimentary ovary none. The *female inflorescence* consists of a large terminal leafy panicle, composed of several gradually curtailed and nodding partial

inflorescences each issuing from the bottom of the sheath of a reduced leaf; the branches or partial inflorescences composing the panicle are 40—45 cm. long, and carry 7—8 approximate, usually very thick and stout, pendulous flower-bearing branchlets or spikes, issuing also from inside the mouths of their respective spathes, and provided with a short pedicellar part; uppermost branches gradually diminishing and consisting of 2—3 branchlets only. Spathes of the main axis of the partial inflorescences infundibuliform, obliquely truncate, rather loosely sheathing, thin but rigid in texture, usually split, produced at one side into a triangular point. Flower-bearing branchlets 25—28 cm. long or less, thinly ferruginously pubescent in every part, having a thick main axis, zig-zag sinuous between the spathels; the latter suffulting the contracted spikelets are obliquely infundibuliform, have a very wide mouth and a narrow base, and are slightly produced at one side into a triangular acute point. The *spikelets* are composed of only two, at times three or at most four, equally developed female flowers, not accompanied by neuter flowers; each flower is furnished with a shallowly cupular truncate involucre, which usually is of one piece, but occasionally appears to be formed of two bracts imbricated by their more or less connate bases; externally to the involucre is a short thickish bracteole. *Female flowers* broadly ovoid, obtusely trigonous, bluntish, about 7 mm. long; the calyx of a thick texture, cupular, with a broad subcallous base, not striate, broadly 3-toothed, obsoletely keeled, slightly hairy, later glabrous, the teeth obtuse; the corolla twice as long as the calyx, parted down below the middle into 3 subcoriaceous broadly ovate acute lobes and covered outside with very fine short stiff appressed hairs; staminal urceolum formed by the connate thickish filaments, united to the corolla only in the basal part and at least for two-thirds free, terminated by 6 short thick deltoid teeth. *Fruit* (immature) roundish-turbinate, but when full grown apparently globular-depressed, flattish above and terminated by the small remains of the stigmas, about 3 cm. in diameter; scales very numerous, but very regularly arranged in about 35 longitudinal series, flattened, with acute tips and very finely fimbrate whitish edges, very faintly grooved along the centre. The pericarp at maturity is fragile. *Seed* apparently covered by a fleshy and very juicy integument; when freed from this globular-depressed, 2 cm., in diameter, with even (non-pitted), surface; albumen equable; embryo basal. *Fruiting perianth* broadly campanulate, finally almost explanate, not accrescent, but becoming hard and almost woody having the teeth of the staminal urceolum alternating with the divisions of the corolla, trigonous, conspicuous between these, although smaller.

HABITAT.—South Burma, the Malay Peninsula, and Sumatra. This Palm was first described and figured by Griffith from specimens collected at Malacca, and it was more recently found again by Scortechini in the District of Perak on Gunong (Mount) Tambang Batak (*Scort.* No. 283*b* in Herb. Becc.). Malay name "Rotang Rahilang." Ridley gives for his *Calamus turbinatus*, which exactly corresponds to *P. geminiflorus*, the locality of Kwala Pilah in Negri Sembilan, and the native name "Rotang Relang."

In Sumatra it has been found with mature fruit, corresponding in every respect to the Malayan plant, by *Dr. Heyne* in Lampong (No. 87 in Herb. Bogor. and Becc.); and in Palembang (No. 26) in the very young stage with sharply 3-cornered sheaths,

having the flat sides 1 cm. wide, and the naked cane also with rather sharp angles; the mouth of the leaf-sheaths is irregularly truncate, produced 15—20 mm. above the insertion of the petiole, and ciliate on the margin. *Scortechini* also collected in Perak a specimen from a young plant of this Palm having trigonous sheaths and stem. The male plant was collected by *Franz Keheding* in Singapore (Herb. Becc.). Recently I have received also a male specimen gathered from a plant cultivated at Buitenzorg and introduced from Palembang in Sumatra. Female specimens, apparently not differing from those of Malacca, are *Meebold's* No. 15237 from Bowachoung in Tavoy in Tenasserim (Herb. Breslau), and No. 29378 of the Herbarium of the Reporter on Economic Products to the Government of India, from the Twet-wa forest, also in Tavoy; Burm. name "Kyein Ni". This last specimen, forwarded to me by *Mr. Burkill*, differs from the Malacca ones in having the leaflets more distinctly spinulous on the margins, and in the perianth of very young fruits having the calyx covered with the same kind of hairs that cover the petals; in this specimen also the first portion of the rhachis is prickly on the upper surface.

OBSERVATIONS.—It is a fine and curious palm, which certainly in the young stage has a sharply trigonous stem, clothed also with trigonous sheaths. It is allied only to *P. Wrayii*, but it is a larger plant than it and has different male and female flowers, although of a similar structure; in this respect differing from *P. paradoxus* and *P. floribundus*, the female flowers and fruit of which being unknown are hardly comparable with the typical species of the genus *Plectocomiopsis.*

My description of the male spadix has been drawn up from a specimen collected by Franz Keheding at Singapore in May 1878 (Herb. Becc.), which is accompained by a portion of a leaf not differing in the slightest detail from the leaves of the typical specimen of the female plant.

In the supplement to *Calamus* (Annals Roy. Bot. Gard. Calcutta Vol. XI, suppl. p. iii) I had reduced *C. turbinatus* Ridley to *Plectocomiopsis Wrayii* Becc., but after the inspection of the type specimen, kindly forwarded to me by Mr. Ridley himself, I have no doubt that it corresponds exactly to the fruiting plant of *P. geminiflorus* Becc.

PLATE 30.—Plectocomiopsis geminiflorus *Becc.*—Branch of the spadix with male flowers in bud; portion of a leaf. From Franz Keheding's specimen in Herb. Becc.

PLATE 31.—Plectocomiopsis geminiflorus *Becc.*—Upper portion of a plant with one of the lowest partial inflorescences with not quite mature fruits. Portion of the sheathed stem from an adult but not yet flowering plant; intermediate portion of a leaf. From Scortechni No. 283*b* in Herb. Becc.

12. PLECTOCOMIOPSIS GEMINIFLORUS var. BILLITONENSIS Becc.

DESCRIPTION.—*Sheathed stem* 2—2·5 cm. in diameter. *Leaf sheaths* of vigorous but not yet flowering plants, thinly rusty furfuraceous, variously armed, at times densely, with very unequal, subulate, flattened spines, 10—20 mm. long or smaller; the mouth oblique, bordered with an elongate, thinly membranous, exsuccous, lacerate, speedly deciduous ocreiform appendage, and often provided at the base of the

petiole with a few spines longer than others ; in the leaves of the flowering panicle the sheaths are less spinous and at times the spines are short and tuberculiform. The petiole is very short in the leaves of the panicle, and is more elongate and more prickly in young plants ; the rhachis is prickly on the upper surface in its first portion. The *leaflets* are as in the type, but are in addition furnished above on the mid-costa with a few conspicuous bristles at times 10—15 mm. long. The *female spadix* is as in type, but the flower-bearing branchlets are usually more slender and have the spathels expanded more suddenly, more concave and almost bracteiform. Involucres of the flowers almost explanate, disciform, usually distinctly formed by two imbricate bracts. The fruiting perianth has the calyx glabrous, the divisions on the corolla covered with short stiff appressed hairs, and the three lobes of the staminal urceolum alternating with the segments of the corolla, thick, triangular and acutely keeled. *Fruit* (not quite mature) globular-turbinate, perhaps smaller than in type, otherwise identical ; scales in 37 longitudinal series.

Habitat.—The Island of Billiton in the Sunda Strait (*Heyne* No. 6 and 2428 *bis* in Herb. Bogor and Beccari).

Observations.—It differs from the peninsular plant in the leaf sheaths more spinous ; in the leaves with prickly rhachis ; in the leaflets with long bristles on the mid-costa ; in the spadix not having so thick flower-bearing branchlets, and in the spathels with a more spreading and almost bracteiform limb.

Plate 32.—Plectocomiopsis geminiflorus var. billitonensis *Becc.*—The end of a plant with immature fruits ; one of the uppermost leaves. From Heyne's specimen in Herb. Becc.

16. Plectocomiopsis geminiflorus var. borneensis Becc.

Plectocomiopsis sp. Becc. in Winkler Beitr. etc. in Engl. Bot. Jahrb. 48, (1912), 92.

P. borneensis Becc. Mss. name in Herb. Hort. Bot. Bog.; Heyne, Nuttige Pl. van Nederl. Ind. (1913) 103.

Calamus triqueter. Becc. Malesia, iii, 62.

Myrialepis triqueter. Becc. in Hook. f. Fl. Brit. Ind. vi, 480. Heyne. Nutt. Pl. van Nederl. Ind. (1913), 103.

Description.—*Sheathed stem* of the upper part of the flowering plant about 3 cm. in diameter, subterete, more or less distinctly trigonous in young individuals. *Leaf sheaths* striate and armed with numerous, small, scattered spines 5—7 mm. long at most but frequently less, or also tuberculiform; in young leaves the mouth of the leaf-sheaths has a more or less lacerated margin and at first is produced into a thinly membranous, deciduous, at times elongate, lacerate, ocreiform appendage. The petiolar part is short in the upper leaves, and apparently is elongate in the lower ones. *Leaflets* as in type, having smooth margins and a few bristles, short or long, on the mid-costa above. The flowering female panicle is apparently very large ; an entire partial inflorescence seen by me, probably one

of the lowest, has the main axis recurved, is 45 cm. long, and carries numerous (18) dependent flower-bearing branchlets, 20—30 cm. long, including a rather slender elongate pedicellar part, which is sheathed by vacuous or non-flower-bearing spathels, otherwise the flower-bearing branches are similar to those of the type, and have the spathels covered with fulvous appressed hairs as usual, but are more acuminate; the involucre is shallowly concave, trigonous, finely ciliate on the margins; the bracteoles are also acute and ciliate. *Female flowers* two or occasionally three at each spathel, apparently subhermaphrodite, very broadly ovoid and obtusely trigonous, bluntish, about 6 mm. long, 5 mm. broad; the calyx is cupular, of a thick structure, and has a subcallous broad base, is broadly 3-toothed, slightly hairy-papillose, but later glabrous; the corolla is twice as long as the calyx, parted down below the middle into 3 pergamentaceous, concave, ovoid, acute segments, covered outside with very appressed very thin hyaline scales. Staminal urceolum thickish, almost entirely free from the corolla, only a little shorter than it and enclosing the pistil; the mouth of the tube is divided into 6 short triangular teeth, representing the filaments, curved inside; each tooth bears an almost normally developed, broadly ovate, subdidymous anther; the young ovary is oblong and bears above a ring of few large imbricating scales; stigmas thickish, broadly linear, connivent, obtuse. *Fruit* unknown.

Habitat.—The type specimen representing this apparently rather distinct variety bears almost fully developed female flowers and was collected by *Dr. Winkler* at Hayup in S.-W. Borneo (No. 2401 in the Breslau and Beccari Herbaria). Specimens from young plants also referable to this variety are *Heyne's* Nos. 20 *bis* and 11 (Herb. Bogor. and Becc.) from Bandjermassin, and most probly also Becc. P. B. No. 2079, the type of *C. triqueter*, from Mt. Mattang in Sarawak.

Observations.—It differs from the plant growing in the Malayan Peninsula, in the partial inflorescences having far more numerous spikes, and furnished with a rather elongate pedicellar part, and especially in the indumentum covering the corolla, which is formed by small flattened pellucid appressed scales, and not by thickish hairs. Heyne's sterile specimens No. 20 *bis* from Bandjermassin are evidently conspecific with Winkler's No. 2401, but belong to younger plants; they have trigonous, densely prickly leaf-sheaths, about 2 cm. in diameter, with rather obtuse angles; the naked stem however is rather sharply trigonous; the petiole is rather elongate and trigonous.

Other specimens from Bandjermassin (Herb. Bogor. No. 20) which I consider as belonging to still younger plants than the foregoing, have slender, acutely trigonous, leaf-sheaths with the sides only 8—12 mm. wide, and the angles very slightly prickly or almost smooth; at the mouth the sheaths have on the side opposite to the petiole a ligula somewhat elongate and perishable; the petiole is rather elongate and trigonous; the pinniferous part has very few leaflets, and ends in a slender rudimentary cirrus; the leaflets have no bristles on the mid-costa, and are provided with 3—4 secondary nerves on each side of it. Apparently the young plants of this *Plectomiopsis* are much less prickly than the adult.

I scarcely doubt that to the same variety of *Plectocomiopsis* is to be reduced *Calamus triqueter* Becc. (P. B. No. 2079). The specimen upon which this species was established is very similar to those described above; its rather sharply trigonous sheathed stem has the 3 sides or faces smooth, slightly convex, 15—18 mm. wide, and the angles prickly; the leaflets have a secondary nerve on each side of the mid-costa more distinct than the other nerves, so as to render these leaflets almost 3-costulate.

Plate 33.—Plectocomiopsis geminiflorus var. borneensis *Becc.*—An entire female partial inflorescence with nearly fully developed flowers. Intermediate portion of a leaf. From Winkler No. 2401.

Plate 34.—Plectocomiopsis geminiflorus var. borneensis *Becc.*—The entire specimen P. B. No. 2079, the type of *Calamus triqueter* Becc. in Herb. Becc.

2. Plectocomiopsis Wrayii Becc. in Hook. f. Fl. Brit. Ind. vi, 480.

Pl. geminiflorus (non Griff.) Ridley, Mat. Fl. Mal. Penins. ii, 214 (partly).

Description.—Rather slender and very highly scandent. *Sheathed stem* of the flowering end 18—22 mm. in diameter, obsoletely 3-gonous. *Leaf-sheaths* not gibbous above, passing very suddenly into the petiole, exactly truncate horizontally at the mouth, of a light colour, very slightly scurfy at first, later glabrescent, sparingly armed with very short, conical, sharp, scattered, pale prickles, or almost smooth; no trace of ocrea or ligula. *Leaves* of the flowering end provided with a petiolar part 8—14 cm. long, 8—10 mm. wide, flattish and slightly furrowed along the centre above, underneath convex and armed along the centre with distant spines, the margins acute and armed with similar distant short, broad-based spines; the rhachis is thinly and fugaciously rusty furfuraceous below, and armed there with distant, at first single, and upwards geminate and then ternate claws; it is concave along the centre in its lower portion, and above upward it has a salient smooth acute angle, and is trigonous in transverse section; the cirrus is elongate and armed at regular intervals with half whorls of claws. The pinniferous part, in leaves of the flowering end, is 0·70 cm.—1 m. long, is shorter in the uppermost leaves and in the lower ones almost certainly is longer. *Leaflets* rather numerous, equidistant, papyraceous, very narrowly lanceolate, largest about their middle, and thence gradually and almost equally narrowing towards both ends, very gradually long-acuminate from about the middle to a very fine capillary smooth or very slightly spinulous tip; the base acute and more or less callous at its axilla; both surfaces green, the lower slightly paler and duller than the upper and under a strong lens, very minutely, though not very distinctly dotted; the mid-costa is slender, usually slightly bristly towards the end on the upper surface; secondary nerves 5—6 on each side of the mid-costa, but frequently hardly distinguishable from the tertiary ones, rather strong and numerous; transverse veinlets short, very sharp on the upper surface; margins not or only very slightly thickened and quite smooth; the intermediate leaflets are the largest, 30—35 cm. long and 2 cm. wide, those of both ends gradually smaller; the leaves belonging to the uppermost branches of the inflorescence are gradually reduced to the sheaths only, and to the rhachises bearing

a few very narrowly linear rudimentary leaflets, and terminating in a slender clawed gradually shorter cirrus. The *male inflorescence* forms a rather large compound terminal panicle, composed of several branches or partial inflorescences, each issuing from the axilla of a reduced leaf; a branch, apparently one of the lowest, is about 50 cm. long, those of the end of the panicle are gradually smaller; the branches have a rather robust arched main axis, and are sheathed by spathes bearing in their axillas the spicigerous branchlets. The spathes of the main axis are greenish even when dry, tubular infundibuliform, closely sheathing, 15—20 mm. long in the exposed part, finely striate, puberulous, almost horizontally truncate at their mouths and produced at one side into a triangular acute or acuminate point. The spikelet-bearing branchlets are inserted near the bottom of their respective spathes through a flattened pedicellar part, and are variable in length according to the position they occupy on the partial inflorescences; the largest branchlets are 25 cm. long and bear distichally 18—20 spikelets on each side; others are much shorter, and have proportionally fewer flowers; spathes of the branchlets rusty-furfuraceous, especially in their basal part, finely striately veined, infundibuliform, their mouths rather wide, truncate, ciliate on the margin and produced at one side into a triangular acute or acuminate point. *Male spikelets* scorpioid, inserted a little inside the mouth of their respective spathes; the lowest and largest are 10—12 mm. long, and have the flowers in two series, each composed of 7—8 assurgent, closely packed flowers; upper spikelets gradually smaller, and with fewer flowers; spathels ringent, bracteiform, acuminate from a broad concave base; involucre shallowly concave, bidentate on the side next to the axis, or as if it were formed by two bracts connate by their bases; spathels and involucra strongly striately veined, iliate and slightly hairy scurfy. *Male flowers* terete, slightly clavate, obtusely apiculate, 5 mm. long, 1 mm. thick; the calyx urceolate-campanulate, of a thickish texture, glabrous, not striately veined, shortly and broadly 3-toothed, the teeth either acute or bluntish; the corolla twice as long as the calyx, solid in its lower part, divided in its upper third into 3 semi-oval acute and thickish lobes; stamens biseriate; the filaments are placed at the upper third part of the corolla, have a thick almost bulbous base and a very suddenly inflexed subulate apex; anthers broad and short, subdidymous, the cells obtuse at both ends and introrse; rudimentary ovary represented by 3 very small subulate papillæ. *Female inflorescence* apparently smaller than the male, and with shorter and less branched partial inflorescences; the one seen by me is about 20 cm. long, and has 5 flower-bearing branchlets; the main axis is sinuous, its spathes are tubular-infundibuliform, closely sheathing, flat at the base on the side of the insertion of the branchlets; the branchlets are 8—13 cm. long, thickish (3 mm. at the base) zig-zag sinuous, have the spathels angular, shortly infundibuliform, suddenly expanded into a bracteiform, spreading, triangular, acute limb. *Spikelets* reduced to only one pair of flowers at each spathel, not accompanied by neuter ones; the pairs of flowers are alternate, distichous and 8—10 on each side of the branchlets; no involucrophorum is visible; involucre flat, triangular-trilobed, striately veined, the lobes acute. *Female flowers* about 1 cm. long, narrowly ovoid-elliptical, conical in the upper part; calyx of a thick texture, cupular-campanulate, obsoletely veined, broadly 3-lobed, the lobes bluntish; the corolla about twice as long as the calyx, thick and very hard, almost woody, finely striately veined and very minutely

papillose outside, tubular-ventricose, divided in its upper fourth into 3 semi-ovate apiculate lobes; filaments of the stamens united to form a tube adnate to the undivided part of the corolla, free above and parted into 6 very thick, short lobes of which 3 are longer than the other 3; all furnished with well conformed cordate-subdidymous anthers, giving to the flowers the appearance of being hermaphrodite; ovary oblong, bearing above a ring of relatively large scales and terminated by 3 thick conical stigmas. *Fruit* globular-turbinate (when thoroughly mature), briefly conically beaked; scales in about 24 vertical series, faintly grooved along the centre, dull, cinnamon-brown with a darker intramarginal line, and pale finely ciliate margins and bluntish apices. *Fruiting perianth* not accrescent but becoming woody; the corolla, and the connate staminal tube splitting into irregular very thick lobes.

Habitat.—The Malay Peninsula: Suñgei Larut plain in the district of Perak (*L. Wray Jun.* No. 2421, male plant, and No. 2422 with female flowers—in Herb. Mus. Perak and Calc.; and *King's collector* No. 5282 Herb. Calc., specimen with young fruits). Probably to *P. Wrayii* belongs a specimen from a young plant collected by *Scortechini* (No. 457*b* in Herb. Becc.) also in the district of Perak, along rivers in wet-ground; native name "Rotang tiga saki" meaning the "trigonous Rotang."

Observations.—It is evidently related to *P. geminiflorus*, but quite distinct by its leaves (even those of the uppermost part of the plant), having a rather elongate petiolar part; by the spadices being considerably smaller and having thinner flowering branches; but especially by the flowers both male and female: the male being very narrow and clavate, the female elongate-elliptical and acute, and with the staminal tube almost entirely connate with the corolla; and finally it differs by the smaller fruit, having fewer series of scales.

Scortechini's specimen No. 457, mentioned above, is taken from a young plant; the sheathed stem has 3 distinct although rather obtuse angles, the faces are 15 mm. wide and slightly convex and sprinkled with short conical prickles; the naked cane is also trigonous with the faces 1 cm. wide. In the first state of their life it seems impossible to distinguish *P. Wrayii* from *P. geminiflorus*, for certainly both at that time have trigonous stems. In *P. Wrayii* that abnormal shape of the stem is maintained also, although rather faintly, in the terminal part of the plant.

Plate. 35.—Plectocomiopsis Wrayii *Becc.*—One of the male partial inflorescence (wanting the end). The type specimen Wray No. 241 in the Calcutta Herbarium.

Plate. 36.—Plectocomiopsis Wrayii *Becc.*—One of the female partial inflorescences. From the type specimen No. 2422 in the Herbarium at Calcutta. Young fruits and a detached fruiting perianth. From King's collector No. 5282 in the Calcutta Hebarium.

3. Plectocomiopsis dubius *Becc.* sp. n.—

P. *geminiflorus* (non Becc.) Ridley, Mat. Fl. Mal. Penins. ii, 214.

Description.—A large climber, 20 or more metres tall (Ridley). *Sheathed stem* very obsoletely trigonous, 3·5 cm. in diameter in the specimen seen by me. *Leaf-sheaths* not puckered above, very suddenly passing into the petiole, truncate exactly

horizontally at the mouth, of a light colour, at first very slightly scurfy, later glabrescent, armed rather densely with very short conical, sharp, scattered, pale prickles ; no trace of ocrea or ligula. *Leaves* moderately large ; the one seen by me apparently belonging to the intermediate part of the plant, has a rather elongate petiolar part, 15 mm. broad, slightly scurfy, flattish above and furrowed along the centre, convex underneath and armed along the dorsum with distant small spines ; the margins acute and provided with distant, short, broad-based spines ; the rhachis of the pinniferous part is thinly rusty-furfuraceous, especially beneath, where armed with distant, at first single, then geminate, and finally 3-nate claws ; it is concave above along the centre in its lower portion, and is trigonous in transverse section upwards ; the cirrus is very long, and armed at very regular intervals with half-whorls of not very strong claws. *Leaflets* numerous, equidistant, 5—6 cm. apart on each side, firmly papyraceous, lanceolate, largest about their middle, gradually and almost equally narrowing towards both ends with the base acute and more or less callous at its axilla and underneath, gradually acuminate from above the middle upwards to a very fine, capillary, slightly bristly tip, glossy above, slightly paler and dull on the undersurface, which is closely sprinkled with very minute pale dots, visible only under a lens ; the mid-costa is slender, smooth or occasionally furnished with 1—2 straggling spinules ; the secondary nerves are numerous, 10—12 on each side of the mid-costa, unequal and connected by sharp transverse veinlets ; margins not or only very slightly thickened, quite smooth ; the intermediate leaflets are 45—38 cm. long, 3—4 cm. broad ; the upper leaflets gradually diminish in size, until the uppermost are reduced to the sheath and rhachis only, the latter bearing few very narrowly linear leaflets and terminating in a slender clawed, gradually shortened cirrus. The *male infloresence* is a large compound terminal panicle, composed of several branches or partial inflorescences, each issuing from the axilla of a reduced leaf ; one of the branches (apparently one of the lowest) is about 65 cm. long, has a rather robust arched main axis, and is sheathed by spathes bearing in their axillas pendulous, slender, flaccid spikelet-bearing branchlets. The spathes of the main axis are greenish even when dry, tubular-infundibuliform, closely sheathing, about 15 mm. long in the exposed part, finely striate, puberulous, almost horizontally truncate at their mouths, and produced at one side into a triangular acute or acuminate point. The spikelet-bearing branchlets are inserted near the bottom of their respective spathes through a flattened pedicellar part, are of variable length, according to the dimension of and the position they occupy on the partial inflorescences ; the largest are 30—45 cm. long and bear distantly up to 30—35 spikelets on each side ; others are only 10—15 cm. long with proportionally fewer spikelets ; spathes of the branchlets slightly scaly-scurfy, striately veined, infundibuliform, the mouths rather wide, truncate, ciliate on the margin and produced at one side into a triangular subulate point. *Male spikelets* scorpioid, inserted a little inside the mouth of their respective spathes ; the lowest and largest spikelets 10—12 mm. long, bearing the flowers in 2 series, each series being composed of 8—10 slightly assurgent, closely packed flowers ; upper spikelets gradually smaller and with fewer flowers ; spathels ringent, bracteiform, acuminate from a broad concave base ; involucre shallow, concave, bidentate on the side, next to the axis, or as if it were formed by two bracts connate by their bases ; spathels and involucra strongly striately veined, ciliate and slightly hairy-scurfy.

Male flowers very small, about 2 mm. long (when not full grown) ovoid, acute; the calyx 3-toothed, strongly striately veined; the corolla deeply parted into 3 ovate lobes; stamens connate by their bases; filaments very thick.

HABITAT.—The Malay Peninsula at Rantau Panjang in the State of Selangor. Collected by *Ridley* in August 1904, No. 12119, (specimen with not fully developed male flowers.

OBSERVATIONS.—It is a very imperfectly known and doubtful species, only the spadices of the male plant having been as yet collected, and these bearing flowers not fully developed. Therefore the specimens upon which the species is established are not exactly comparable with those of *P. Wrayii*, to which *P. dubius* seems however closely related. We may even suppose that *P. dubius* represents a juvenile stage of *P. Wrayii*, from which it apparently differs in the flowers having a strongly striately veined calyx, and in the corolla ovate and deeply parted, if its shape does not change when it attains its full development; further the leaflets of *P. dubius* have apparently far more secondary nerves than those of *P. Wrayii*, and are more distinctly dotted underneath. In conclusion; *P. dubius*, established on Ridley's No. 12119, must be considered as yet as a doubtful species, but certainly not referable to *P. geminiflorus* as has been stated by Ridley (l. c). In Ridley's description of *P. geminiflorus* are incorporated characteristics not only belonging to that plant, but also to *P. dubius* and to *P. Wrayii.*

PLATE 37.—Plectocomiopsis dubius *Becc.*—Portion of the sheathed stem of the flowering plant; an entire partial inflorescence with young male flowers; intermediate portion of a leaf. From Ridley's No. 12119 in Herb. Becc.

LATIN DIAGNOSIS.—Plectocomiopsis dubius *Becc.* sp. nov. Robustus, caudice vaginato obtuse trigono, ultrapollicari; vaginis crebre aculeis breviter conicis sparsis armatis; frondibus longiuscule petiolatis, segmentis numerosis, aequidistantibus, nervis secundariis pluribus percursis, punctis exiguis numerosis subtus obsitis; spadice paniculato, amplo, ramis spicigeris numerosis gracilibus; floribus parvis ovoideis acutis, calyce conspicue striato-venoso.

4. PLECTOCOMIOPSIS? PARADOXUS Becc. in Hook f. Fl. Brit. Ind. vi, 480.

Calamus paradoxus Kurz in Journ. As. Soc. Beng. xliii (1874) 213, t. XXIX, XXX and For. Fl. Brit. Burma, ii, 521.

DESCRIPTION.—Scandent and rather large. *Sheathed stem* 2·5—5 cm. in diameter. *Leaf-sheaths* not gibbous above, gradually passing into the petiole, having no ocrea or ligula at the mouth, finely striate, covered with a thin, pale rusty-furfuraceous probably fugacious coating, armed with interrupted series or half circles, 2—3 cm. apart, of confluent, pectinate, slender, straight, flattened, yellows, deflexed spines. *Leaves* about 1·5 m. long in the pinniferous part and terminating in a powerfully clawed cirrus; petiole very short, flat above, convex beneath, armed beneath at the sides and along the middle with straight spines; rhachis flat above in its lower portion, obsoletely bifaced with a very obtuse but salient angle higher up, roundish beneath and armed there in its lower part, along the dorsum, with recurved spines, which are gradually transformed above into stout 2—3-nate claws, becoming in the

cirrus half or three quarter whorled, almost regularly, at the distances of 3—4 cm. without other spines interposed. *Leaflets* not numerous, about twenty in one specimen; the lowest and uppermost much reduced in size or rudimentary; very unequidistant, usually in pairs on each side of the rhachis; the pairs of one side irregularly alternating with those of the other side, and with long vacant spaces interposed; they are narrowly lanceolate, tapering below to an acute base, gradually acuminate above to a fine, often elongated tip, thinly papyraceous, almost equally green on both surface, but marked underneath with very minute pale dots (microlepidia); have the mid-costa slender, almost equally prominent on both surfaces, and accompanied by 4—5 fine secondary nerves on each side; tertiary nerves numerous; along both margins runs a nerve about as strong as the mid-costa; transverse veinlets visible only by transmitted light; all nerves are devoid of bristles or spinules; margins appressedly spinulous; of the intermediate leaflets, the largest are 30—40 cm. long, and about 3 cm. wide. *Male spadix* large and ultradecompound; the branches seen by me form rather loose panicles 20—40 cm. long, are completely unarmed in every part, and carry distichally and alternately, on each side, 5—8 gradually decreasing spikelet-bearing branchlets, each of which issues erect from the mouth of its respective spathe, but soon becomes arched and spreading; the secondary spathes *i.e.*, the spathes of the branches are infundibuliform, loosely sheathing, striately veined, entirely glabrous, truncate and ciliate at their mouths and produced at one side into a triangular acuminate point. The spikelet-bearing branchlets gradually decrease upwards, the lowest and largest 12—20 cm. long, and carrying distichally 7—9 spikelets on each side; the *spikelets* in the dry specimens are uniformly brown, glabrous in every part, scorpioid, some of them at times subdivided, all very short, the lowest the largest, 10—12 mm. long, and shortening towards the end of the branchlets; they have two series of closely packed assurgent flowers, each series composed of 5—6 flowers, fewer in the uppermost spikelets. Spathels bracteiform, membranous concave, acute at one side, all but completely embracing the floral involucre; the latter is rather deep, obliquely truncate, flat on the axial side, and sharply 2-keeled at one side, each keel ending in an acute tooth. *Male flowers* ovoid-subtrigonous, narrowing toward the base, acute, 4—5 mm. long; the calyx deeply parted into 3 ovate, rather acute lobes (the lobes remaining on the axial side acutely keeled), striately-veined, the margins hyaline; the corolla twice as long as the calyx, divided in its lower third into 3 segments, thinly cartilaginous, striately-veined, apiculate and with thick margins. Stamens 6; the filaments united together in their lowest part, broadly linear or nearly oblong, thick and fleshy in the free part, which is about as long as the segments of the corolla, nearly capitellate a little below the apex, and from that point very suddenly introflexed, subulate and very slender. Anthers erect in the præfloration, inserted about their middle, linear-sagittate, rather acute, narrower than the broadened part of the filaments, and almost encased in these, the anther cells deeply divided at the base. Rudimentary ovary very minute. *Female spadix* and fruit unknown.

Habitat.—Pegu. The male plant only was collected by Kurz in the forest of Palawa Zeik (Toukyeghat) in Martaban to the east of Tounghoo, flowering in April (Kurz No. 1475, in the Herbaria of Kew, Petrograd and Calcutta). Native name "Yamatha Khyeing."

Observations.—The habit of this palm is that of a *Plectocomia*, the leaf-sheaths not being puckered above, gradually passing into the petiole, and not having ocrea or ligula at the mouth. The stem and leaves are very much like the corresponding parts of *Myrialepis Scortechinii*, and the leaves, as in it, have also the lower surface covered with microlepidia. Its generic position, as that of *P. floribundus* remains uncertain because their female flowers and fruits are unknown, and because in many respects *P. paradoxus* and *P. floribundus* more resemble *Myrialepis Scortechinii* than *Plectocomiopsis geminiflorus* and *P. Wrayii.*

P. paradoxus is characterized by its leaves with grouped lanceolate leaflets, having all nerves smooth and being dotted with microlepidia underneath, and by the peculiar structure of the male flowers. It is certainly a palm with terminal definite inflorescence.

Plate 38.—Plectocomiopsis paradoxus (*Kurz*) *Becc.*—Upper part of a flowering male partial inflorescence. From one of the typical specimens in the Herbarium at Petrograd.

5. Plectocomiopsis? floribundus Becc. in Webbia, iii, (1910) 239.

Description.—Scandent and of moderate size. *Leaf-sheaths* marked by the depressions stamped upon them by the spines during the præfoliation, covered with an adherent dark-brown or rusty-furfuraceous scurf, and armed with obliquely seriate, slender, acicular, light coloured spines, frequently confluent by their bases and 10—12 mm. long at most. *Leaves* (apparently belonging to adult plants) 1 m. long (at times even more?) in the pinniferous part; the petiolar part very short, thickish 2—4 cm. long, 1 cm. broad, concave on the upper, convex on the lower surface, armed on the outer margins with straight spines; on its back the spines are straight, often geminate or ternate and deflexed; the rhachis on the upper surface of its lower portion is convex, and from the middle upwards has two faces separated by a not very sharp salient angle; at times it is spinulous on the sides; on the lower surface, lower down along the centre, it is armed with a line of straight deflexed, often geminate spines, which higher up are gradually transformed into rather robust claws at first geminate, then ternate and finally regularly half whorled; in the cirrus both petiole and rhachis covered with a thin tobacco-coloured indumentum, later partially deciduous. *Leaflets* about 30 in all (besides a few rudimentary at the upper end) very distinctly approximate in fascicles of 2—3 on each side of the rhachis, the fascicles of one side being almost opposite to those of the other side, and forming on the whole 5—6 very distinct groups, separated by long vacant spaces; the leaflets are papyraceous, more or less narrowly lanceolate, broadest below the middle, tapering thence to an acute, strongly plicate base, and narrowing above to a gradually acuminate and finely subulate tip; are equally green on both surfaces, but on the lower surface are distinctly dotted with very minute orbicular pale microlepidia; the mid-costa is slender and on each side of it are 5—6 very slender secondary nerves; transverse veinlets short, immersed in the parenchyma and visible only by transmitted light; both margins conspicuously thickened and frequently armed with distant, pale, short, spreading, at times conspicuous spinules, otherwise quite smooth; the intermediate leaflets (the largest) mostly 20—30 cm. long, sometimes

less, and 2·5—3 cm. wide, but in non-cirriferous leaves up to 50—55 cm. in length, though not broader; the remaining leaflets, from the middle of the rhachis upwards, and also those nearer to the base, becoming gradually smaller. *Male spadix* apparently large, ultra-decompound (not seen entire by me); the summit of one (or of a partial inflorescence?) is 40 cm. long and forms a large rather dense panicle, composed of several (about 12 in all) gradually shortening, distichally inserted (primary?) branches, distinctly arched scorpioid, as are its subdivisions; spathes (secondary or tertiary?) elongate-infundibuliform, glabrous, very finely striately veined, almost horizontally truncate at the mouth and abruptly extended at one side into a triangular acuminate point; branches (secondary?) inserted inside their respective spathes by means of a distinct, flattened pedicellar part: the lower branches (the largest) 25—30 cm. long, with 18—20 gradually diminishing spikelet-bearing branchlets; their spathes are infundibuliform, as are also the secondary or tertiary ones, but smaller, loosely sheathing, widening and glabrous in their upper part, narrowing below and strongly furfuraceous at the base; the lower branchlets of every branch are 7—8 cm. long, and carry distichally 8—10 spikelets on each side; upper branchlets gradually shorter and with fewer spikelets; the spathes of the branchlets are infundibuliform, have a very wide mouth, truncate and ciliate, and produced at one side into a triangular point; are strongly striately veined; have the base narrow and furfuraceous; otherwise are glabrous. *Spikelets* conspicuously scorpioid, 8—10 mm. long, or shorter towards the end of the branchlets, bearing two series of very closely packed assurgent flowers, each series composed of 4—6 flowers; spathels bracteiform, membranous, concave, keeled, strongly striately veined, acuminate from a broad base and completely embracing the involucre; the latter concave, sub-dimidiately cupular, produced on the side next to the axis into 2 very acuminate points. *Male flowers* rather broadly ovoid, acute, obsoletely trigonous, 3 mm. long; the calyx membranous, split almost to the base into 3, ovate, strongly striately veined, acute lobes; the corolla about one-half times longer than the calyx, parted almost to the base into 3 elliptical, boat-shaped, pergamentaceous segments, strongly striate externally, slightly thickened at the edges, and with a callous apiculum; the stamens have the lower part of the filaments fleshy and thickish, about as long as the corolla, linear-oblong and united together in their lower third part, where they form a kind of cup; the lower and relatively broad and fleshy part of the filaments is very abruptly contracted into an introflexed, very slender subulate thread (shorter than the thickened part) which carries the anther; the anthers stand erect before the anthesis, and are dorsally attached about their middle, elongate-sagittate, narrower than the erect basal part of the filament, deeply disjunct at the base, rather acute at the apex, and having the cells opening laterally. Rudimentary ovary very small, papilliform. Other parts unknown.

HABITAT.—Indo-China. In Cambodia (*Gourgaud*); native name "Pfdau-ch s;" specimen with male flowers in the Paris Herbarium. Collected also in Cochin-China in a sterile condition by *Dr. Thorel*, but the exact locality not stated. Sterile specimens were also collected between Saigon and Phantiet by *Lecomte* and *Finet* in Dec. 1911.

OBSERVATIONS.—Apparently closely related to *P. paradoxus*, but with leaflets very distinctly grouped (whereas in *P. paradoxus* they are simply unequidistant) and with flowers at least one-third larger, narrower and more acute than in *P. paradoxus*. Both species have the leaflets sprinkled underneath with pale dots. One of the specimens collected by Lecomte and Finet has a leaf from an adult plant terminated by a long clawed cirrus. Another leaf is not cirriferous, and the rhachis is armed with 3—5-nate, straight, deflexed spines; the lower leaflets are 50—55 cm. long, very long-acuminate, have the margins distinctly thickened and ciliate with pale spines, often conspicuous, and in pairs, occasionally 5—6 mm. long.

I have referred this Palm to the genus *Plectocomiopsis*, but like *P. paradoxus* it shows marked affinities with *Myrialepis*, and its generic position can be fixed with certainty only when the female flowers and fruit shall be known.

PLATE 39.—Plectocomiopsis floribundus *Becc.*—The end of an inflorescence (partial ?) and intermediate portion of a leaf. From Gourgaud's specimen in the Paris Herbarium.

MYRIALEPIS Becc.

Becc. in Hook. f. Fl. Brit. Ind. vi, 480.

A large, scandent, diœcious, monocarpic Palm. *Inflorescence* terminal, composed of several branches, each of which proceeds from the leaf-sheath of a reduced leaf. *Leaves* of the adult plant cirriferous, having the leaf-sheaths non-gibbous above, gradually passing into the petiole, and without ocrea or ligula at their mouths. *Leaflets* straight, acuminate, unicostulate with several secondary nerves, and besprinkled with microlepidia on the under surface ; the margins slightly thickened. *Male inflorescence* large, several times branched ; all the branches provided with tightly sheathing spathes. Male spikelets short, scorpioid, furnished with spathellulas and involucra as in *Calamus*. *Male flowers* . . . . *Female spadix* very different from the male, and less divided. Spikelet-bearing branches provided with short infundibuliform spathes ; spikelets very few-flowered, inserted just at the mouth of their respective spathes. *Female flowers* are solitary at each spathel, provided with only one cupular involucre unaccompanied by a neutral flower and globular-ovoid during the anthesis ; the calyx deeply 3-lobed ; the corolla deeply 3-parted ; the stamens forming with the broadened bases of the filaments a nearly entirely free membranous cup, with 6 radiating anther-bearing teeth ; the anthers sterile, sagittate. Ovary globose, 3-locular, covered with very minute rudimentary scales ; the cells uniovulate ; ovule anatropous, basilar ; stigmas short and thick, trigonous, at first connivent, later divaricate. *Fruit* globose, having the pericarp fragile and covered with innumerable irregularly set, extremely minute scales. *Seed* solitary, globose, having a scanty integument and an even surface ; chalazal fovea punctiform, apical ; embryo basal ; albumen equable.

The genus *Myrialepis* is especially characterized by the male spadix being larger and considerably more branched than the female ; by the female flowers being solitary at each spathel, furnished with only one involucre and not accompanied by a neuter flower ; otherwise on the whole the female flower of *Myrialepis* is very much like that of *Plectocomiopsis ;* but above all it is characterized by the fruit being clothed with extremely minute, not regularly or seriately set, almost tuberculiform scales. (In my monograph of *Calamus* vol. XI., p. 29 of these Annals) I have made mention of *Myrialepis* in regard to the nature of the scales that cover the pericarp).

Myrialepis is certainly allied under several aspects to *Plectocomiopsis*, but the female flowers in the two genera are widely different. Moreover in *Plectocomiopsis* the scales clothing the fruit although very numerous, are nevertheless regularly arranged in orthostichies and parastichies, whereas in *Myrialepis* no order exists and it would be vain to attempt to count them. Only one species of *Myrialepis* is with certainty known. I have, however, already remarked that *Plectocomiopsis paradoxus* and *P. floribundus* may possibly be referable to *Myrialepis* ; but the male flowers of *Myrialepis* are not known and of the two other species mentioned the female flowers and fruit are wanting ; such a circumstance renders a rigorous comparison between them impossible.

DESCRIPTION OF PLATE II B.

Fig. 1–7. Myrialepis Scortechinii *Becc.*—Fig. 1. Spikelet with female flowers in bud.—Fig. 2. One of the flowers from the spikelet above.—Fig. 3. Female flower during the anthesis.—Fig. 4. Ovary from a flower not yet open.—Fig. 5. Ovary with its sterile androecium from a flower during the anthesis—Fig. 6. Longitudinal section of the ovary.—Fig. 7. Transverse section of the ovary. All figures enlarged.

MYRIALEPIS SCORTECHINII Becc. in Hook f. Fl. Brit. Ind. vi, 480.

Plectocomiopsis annulatus Ridley, Mat. Fl. Mal. Penins. ii, 213 (The male plant).

Plectocomiopsis Scortechinii Ridley l. c. (Fruit).

DESCRIPTION.—A very high scandent palm of the habit of a *Plectocomia. Sheathed stem* 5—6 cm. in diameter (and at times more), terete even in the young plants. *Leaf-sheaths* thickly coriaceous, non-gibbous above, gradually passing into the petiole, strongly striate longitudinally, armed in young plants with complete, oblique whorls of robust, flattened, pale spines, 3—4 cm. loug, confluent by their bases ; in the adult plant the spines form short series of 4—5 or also half rings on the sides ; along the dorsum the spines are in groups of 3—5 with the spino in the centre longer than the others ; no trace of ocrea or ligula at the mouth. *Leaves* large, terminated by a robust clawed cirrus ; petiole more or less elongate, robust, concave above, convex beneath ; its margins more or less spinulous ; the dorsum is armed, like the first portion of the rhachis, with straight, robust, deflexed spines, single or ternate ; the rhachis in its lower portion is shallowly channelled above, but higher up becomes subterete or obsoletely angular, and is armed along the dorsum with robust spines, at first straight, single or digitate with the central spine longer than the others, but finally transformed into half or three quarter whorls of very robust claws. *Leaflets* numerous, unequidistant, in alternate or opposite groups of 2—3 on each side of the rhachis, with vacant spaces of variable length interposed between the groups, lanceolate, almost equally narrowing towards both ends, the base acute, the tip acuminate, regular or very obsoletely indented 2—3 cm. below the apex, papyraceous, green on both surfaces but besprinkled underneath with very minute pale dots (microlepidia) ; the mid-costa slender, almost equally prominent on both surfaces and accompanied by 5—6 fine secondary nerves on each side of it, often not much more distinct than another nerve interposed between each of them ; along both margins runs a nerve about as strong as the mid-costa ; transverse veinlets indistinct ; all nerves are without bristles or spinules ; the margins are slightly ciliate-spinulous from above the middle only ; the largest leaflets are 35—40 cm. long, 3—5·5 cm. wide. The leaves of the upper part of the plant are gradually smaller ; those immediately below the inflorescence are reduced to the sheath and rhachis only, bearing a few linear leaflets and terminated by a short clawed cirrus. *Male inflorescence* large and several times branched ; spathes tubular-infundibuliform, soon perishable ; the branches of the third or fourth degree carry several spikelet-bearing gradually decreasing branchlets, of which the lowest are 6—7 cm. long and carry distichally 8—10 spikelets on each side ; upper branchlets shorter with fewer spikelets ; the spathels of the branchlets are infundibular,

angular, obliquely truncate at the mouth, and produced at one side into a triangular acute or acuminate point. *Spikelets* small, scorpioid, gradually decreasing in length and number of flowers, the lower and largest 10 mm. long carry two collateral series, of 6—8 assurgent flowers each; spathels small, very approximate, concave, acute at one side; involucre cupular, shallow, with 3 acute teeth. *Male flowers* . . . *Female inflorescence* large, composed of several branches (partial inflorescences) 30—40 cm. long or shorter, each of which proceeds from the sheath of a greatly reduced leaf, and carries distichally 5—7 or fewer spikelet-bearing branchlets; the main axis is sinuous; the secondary spathes are slightly infundibuliform, flat at the base on the inner side, unarmed, striately-veined, almost horizontally truncate at the mouth, produced at one side into a triangular acuminate point; branchlets spreading or recurved inserted just at the mouth of their respective spathes; the lowest and largest 10—16 cm. long, and bearing 8—10 spikelets on each side; the upper speedily decreasing in length and number of spikelets; spathes of the branchlets similar to those of the main axis, but smaller, fugaciously ciliate-furfuraceous on the margin; *spikelets* scorpioid, inserted just at the mouth of their respective spathes, composed of only 3—5 flowers; the spathellules are bracteiform, concave, produced at one side into a triangular acuminate point, embrace the special and the only existing involucre of the flowers, are shallowly cupular, almost explanate, trigonous 3-toothed, 2-keeled on the axial side, and not showing any trace of the insertion of a neuter flower. Before the anthesis the *female-flowers* are about 8 mm. long, ovoid, trigonous-pyramidate above, have the ovary provided with a broad ring of very minute points (the rudiments of the scales) spreading and later deflexed; during the anthesis the female flowers are globular-ovoid, 7—8 mm. long, 6 mm. across; the calyx is deeply parted nearly to the base into 3 broadly triangular, striately veined, very acute segments; the staminodes form with the broadened connate bases of the filaments a shallow membranous cup, connate only at the base with the undivided part of the corolla and radiately divided into 6 deltoid teeth, each terminated by a rudimentary sagittate anther; the 3 alternipetal teeth are conspicuous between the segments of the corolla; the anthers have the apex and the auricles acute; ovary globose, 3-locular, very densely and minutely covered with the small rudimentary scales; stigmas short, very thickly trigonous, divergent; ovules basilar. *Fruit* monospermous, globular, slightly depressed, 26—28 mm. in diameter, having the top round and marked by the very minute punctiform scar left by the stigmas, covered by innumerable extremely minute, subtuberculiform, irregularly imbricate scales, about ·5 mm. wide and prolonged into very acuminate straight appressed tips. The pericarp on the whole is about 1 mm. thick, and coriaceous. *Seed* transversely oblong and depressed. 18 × 25 mm. in diameter, 15 mm. high in one specimen, covered by a thin crustaceous, adherent (once slightly fleshy?) integument, otherwise its surface even and marked only by a small punctiform apical chalazal fovea; albumen homogeneous; embryo basal. *Fruiting perianth* persistent, broadly campanulate; the calyx slightly thickened and with a callous base.

HABITAT.—The Malay Peninsula and probably also Sumatra. The type specimen is a small branchlet bearing a few mature fruits, collected by *Scortechini* in the District of Perak. *Scortechini* collected also in the same district some sterile

specimens of this Palm, from a nearly adult plant (No. 513^{b} in Herb. Becc.) Native name "Perwal." I have also a sterile specimen collected by *Fr. Keheding* at Malacca. Since then it has been found by *Ridley* with female flowers and fruits in Singapore at Bukit Mandai (No. 5680 in Herb. Calc. and Becc.: 5860 in Ridley l. c.?) and in the garden jungle (*Ridley* No. 12500 with female flowers in Herb. Becc.). The male plant is represented by *Ridley's* No. 11457 (in Herb. Becc.) also from Singapore at Bukit Timah. Some sterile specimens of a Palm collected by *Heyne* in East Sumatra at Palembang (No. 20 Herb. Bogor.) and in Lampong (No. 120 Herb. Bogor.) apparently are referable to *Myrialepis Scortechinii.*

Observations.—It is a very distinct Palm, which, especially when young, resembles a *Plectocomia*, from which however it is easily distinguishable, even in a sterile condition, by its leaflets being distinctly sprinkled on the lower surface with pale microlepidia, which are invariably wanting in the *Plectocomias.* The male inflorescence differs considerably from the female one. I have described it from the same specimens which were considered by Ridley (No. 11457) as belonging to *Plectocomiopsis annulatus;* the inflorescence in these specimens is withered, being apparently of a very perishable nature, and not one flower was left. To the same *P. annulatus* Ridley has referred his No. 12500, which bears female flowers in no way distinguishable from those of his No. 5680 (or 5860?) which he really considers as representing my *Myrialepis Scortechinii*, which it certainly does.

The specimens from Sumatra, which I doubtfully refer to *Myrialepis Scortechinii*, are represented by several portions of a very large leaf; the leaf-sheath is 7 cm. in diameter and has the same kind of spinescence as the typical specimens, but it is spinous also on the rim of its mouth; the petiole is very stout; the leaflets are as exactly described above, but have the under surface slightly paler than the upper and are very minutely and closely sprinkled with very minute, slightly prominent dots; in the typical specimens the dots or microlepidia are appressed. These specimens, if not exactly identical with the Malayan plant, probably represent an allied species.

Plate 40.—Myrialepis Scortechinii *Becc.*—A branch of the male inflorescence having lost all its flowers; intermediate portion of a leaf; from Ridley's No. 11457 in Herb. Becc. Portion of a sheathed stem from a young plant; from Scortechinii's No. 513^{b} in Herb. Becc.

Plate 41.—Myrialepis Scortechinii *Becc.*—An entire partial inflorescence with female flowers in bud; a spikelet-bearing branchlet with female flowers during the anthesis (in the upper part of the plate); portion of a leaf; two mature fruits, one cut to show the seed *in situ*; from Ridley's No. 5680 in the Calcutta Herbarium. Small partial inflorescence with nearly mature fruit (Scortechini's type specimen) and a leaf-sheath of an adult plant, also from Scortechini in Herb Becc.

ZALACCA Reinw.

Reinw. in lit. ad Mart. ex Mart. Hist. Nat. Palm. iii, 199, t. 118, 119, 123 136 and 159, f. 2; Rumph. Herb. Amb. v, 113; Blume in Schult. Syst. Veget. vii, 1333, Obs. 3; Blume, Rumphia, ii, 158; Endl. Gen. No. 1737; Meisn. Gen. 354 (265); Wall. Pl. Asiat. Rar. iii, t. 222—224; Grifi. in Calc. Journal Nat. Hist. v, 8, and Palms Brit. Ind. 9, t. clxxv—clxxx; Miq. Fl. Ind. Bat. iii, 80; Becc. Malesia, iii, 63; Kurz, For. Fl. Brit. Burma ii, 511; Hook. f. Fl. Brit. Ind. vi, 472; Ridley, Mat. Fl. Mal. Penins. ii, 168; *Salacca* Reinw. in Syll. Plant. ii, 3.

Cæspitose, almost stemless, spinous, dioecious palms, having large, pinnate, non-flagelliferous leaves. *Leaflets* lanceolate or linear-lanceolate, tricostulate, almost always sigmoid or at least falcately acuminate. *Spadices* interfoliaceous, very dissimilar in the two sexes, enveloped in several incomplete membranous, mostly lacerated and perishable spathes. *Male spadices* branched, bearing several catkinlike, cylindrical spikes, composed of very approximate bracts (spathels) more or less connate by their margins. *Male flowers* two and equal at the axilla of every spathel, ovate, clavate or oblong, accompanied by special bracteoles usually hairy or woolly; the calyx thinly membranous or hyaline, deeply 3-parted; the corolla longer than the calyx, having a fleshy undivided base, and parted into 3 thinly cartilaginous lobes; stamens 6, inserted at the throat of the corolla; filaments short, subulate; anthers erect, basifixed; rudimentary ovary extremely minute, placed at the base of the tubular part of the corolla. *Female spadix* less branched than the male and with fewer spikes. Female spikes larger than the male ones, torulose or squarrose (*Euzalacca* and *Eleiodoxa*), or small and composed of very few flowers (*Leiozalacca*); the spathels at first connate by their margins, then separating, larger and less crowded than in the male spikes, each carrying a female flower accompanied by a neuter one (in the species of the *Euzalacca* and *Eleiodoxa* section), the female having two bracts, and the neuter only one; the neuter flower is wanting in the species of the *Leiozalacca* section. *Female flowers* larger than the male ones, ovoid; the calyx membranous, split into 3 parts; the corolla coriaceous, about as long as or slightly longer than the calyx, having a ventricose or urceolate entire base, and divided above into 3 valvate segments; staminodes 6, inserted at the throat of the corolla; ovary distinctly 3-celled, ovoid, strigose from being covered with scales prolonged into ascending or spreading spiculæ (*Euzalacca*), or less frequently flat and appressed (*Leiozalacca* and *Eleiodoxa*). *Fruit* relatively large, mono-trispermous, globose, turbinate or ovoid covered with reversed scales terminating in a rigid spiculiform upturned point (*Euzalacca*) or smooth and appressed (*Leiozalacca* and *Eleiodoxa*). *Seed* oblong, globular or obsoletely angular, enveloped by a fleshy, often abundant and very acid, integument of which an intrusion penetrates into the albumen from an apical pit; the surface of the nucleus smooth; albumen homogeneous; embryo basal.

The genus is sharply divisible into 3 sections or subgenera. The more numerous and more characteristic representatives of the genus (the *Euzalacca*) are sharply separated from the others by the strigose ovary and the corresponding hispid subspinous fruit; moreover in the species of this group the female flowers are accompanied by a neuter one and are crowded into cylindrical spikes. In the second group the female

spadix carries very reduced spikes, containing very few female flowers not accompanied by a neuter one, and the fruit is covered with flat, appressed, smooth scales. The third group (*Eleiodoxa*) has the female flowers crowded together, as in *Euzalacca*, into cylindrical spikes, each flower being accompanied by another flower, neuter or male ; the fruit is monospermous and clothed with smooth scales, and has the seed of a special conformation.

GEOGRAPHICAL DISTRIBUTION.—*Zalacca* is one of the most characteristic exclusively Indo-Malayan genera of Palms. The 13 species at present known flourish chiefly in the very rich soil of the recesses of the primeval forest, or in very damp situations. *Z. secunda* is the most northerly species being indigenous to Upper Assam and the Mishmee Mountains ; it stands alone and has no close affinities with the other continental species *Z. Wallichiana*, found more to the south in Burma, Tenasserim, Siam, Cochin-China and the Malay Peninsula. To *Z. Wallichiana* are related not only *Z. glabrescens*, which likewise grows in the Malay Peninsula, but also the insular Malayan species, viz. *Z. Blumeana*, *Z. edulis*, *Z. vermicularis*, *Z. sumatrana* and *Z. Clemensiana* of the Philippines, all being characterized by having hispid spiculiferous fruits. *Z. affinis* from Malacca, of the *Leiospatha* group, has its representative in the Bornean *Z. dubia*. *Z. conferta* and *Z. Scortechinii* (*Eleiodoxa*) are gregarious marsh palms, growing in the Malay Peninsula, in Borneo, Riow and Bangka, but they are apparently not common plants. The native country of *Z. dubia* is not known. It is found only in cultivation at Buitenzorg, but most certainly is a native of one of the Malay Islands.

The precise place of origin of the Malayan *Z. edulis* is also as yet uncertain, it being a plant that frequently receives a kind of rudimentary culture, on account of its edible acid fruits.

	—	Upper Assam, Mishmee Mts.	Burma, Siam, Mergui Arc., Indo-China.	Malay Peninsula.	Riow.	Bangka.	Sumatra.	Java.	Bali.	Borneo	Amboina.	Philippines.
	ZALACCA.											
1	Z. edulis *Reinw.*	...	...	...	...	...	...	...	+	...	...	...
	„ *var.* amboinensis *Becc.* ...	...	...	...	...	...	...	...	...	...	+	...
	„ *var.* riowensis *Becc.* ...	...	...	...	+	...	...	...	...	...	...	...
2	Z. vermicularis *Becc.*	...	...	...	...	...	...	...	...	+	...	...
3	Z. Blumeana *Mart.*	...	...	..	...	...	...	+	...	...	...	...
4	„ *var.* Rimbo *Becc.* ...	...	...	...	...	...	+	...	...	...	...	...
5	Z. sumatrana *Becc.*	...	...	...	...	...	+	...	...	...	...	...
6	Z. Clemensiana *Becc.*	...	...	...	...	...	...	...	...	...	...	+
7	Z. Wallichiana *Mart.*	...	+	+	...	...	...	...	...	...	...	...
8	Z. glabrescens *Griff.*		...	+	...	...	...	...	...	...	...	...
9	Z. secunda *Griff.*	+	...	...	...	...	...	...	...	...	...	...
10	Z affinis *Griff.*	...	...	+	...	...	+	...	...	...	...	...
11	Z. dubia *Becc.*	...	...	...	...	...	...	...	...	...	...	...
12	Z borneensis *Becc.*	...	...	...	...	...	...	...	...	+	...	...
13	Z. conferta *Griff.*	...	...	+	...	+	...	...	...	+	...	...
14	Z. Scortechinii *Becc.*	...	...	+	...	...	...	...	...	...	...	...

ZALACCA.

Key to the species.

(On account of the great dissimilarity between the male and the female spadix, it would have been desirable to have one key constructed according to the characters offered by the male spadix, and another according to those of the female spadix, and especially by the fruits; but to make this double key has proved unfeasible, owing to the circumstance that in several species one or the other of the necessary organs are as yet unknown).

A—Euzalacca.—*Ovary strigose or beset with sharply pointed, erect, stiff, almost hairy scales. Female spikes larger than the male ones, having two flowers at each spathel, one of which is female (or apparently hermaphrodite) and the other a male or neuter. Fruit clothed with spiculiferous or subulate scales.*

* Leaflets more or less sigmoid, whitish beneath and having the midcosta only spinulous above. Fruit clothed with scales having a spinuliform upturned tip.

† Male spikes having the spathes connate into circular rings.

§ Leaflets unequidistant.

a. Male spikes elongate, flexuose, at first vermiform, and with appressed spathels later subsquarrose or with slightly longer than the spathels; the divisions of the corolla spreading gaping spathels. Male flowers during the anthesis.

Leaflets narrowly lanceolate. Male spadix nodding or trailing.

1. Z. edulis Reinw. (forma typica). Malay Archipelago.

Leaflets linear.

Z. edulis var. **amboinensis** Becc.—Amboina.

Leaflets narrowly lanceolate. Male spadix with shorter branches than in *forma* typica.

Z. edulis var. **riowensis** Becc.—Riow.

b. Male panicles erect cupressiform; male spikes vermiform, entirely exserted from the spathes; the spathels appressed, short, ring-like, with the wool of the special flower-bracts longer than the spathels and giving a tomentose appearance to the spikes. Male flowers with the division of the corolla spread open during the anthesis.

2. Z. vermicularis Becc.—Borneo.

c. Male panicles erect ; spikes digitiform, shorter or slightly longer than the spathes ; flowers clavate, so numerous as to conceal the spathels and having the division of the corolla erect (not spreading) during the anthesis. Seed obtusely trigonous.

3. Z. Blumeana Mart.—Java.

Fruit more or less turbinate.

Z. Blumeana Mart. (type) Java.

Fruit globular, very slightly narrowing to the base.

Z. Blumeana VAR. **Rimbo** Becc.—Sumatra.

§ § Leaflets equidistant. Fruit turbinate, tapering to a narrow rather elongate base. Seeds irregular, obtusely angular, and somewhat flattened.

4. Z. sumatrana Becc.—Sumatra.

† † Male spikes having the spathels individually distinct, *i.e.*, not connate and not forming annular rings. Leaflets in groups.

5. Z. Clemensiana Becc.—Mindanao.

* * Leaflets green on both surfaces.

† Fruit clothed with appressed rhomboidal scales, having a spinuliform upturned tip.

§ Leaflets oblanceolate, narrowing to a straight base (not or very slightly sigmoid) ; the costæ smooth or the mid-costa only spinulose near the apex. Male spikes tomentose. Fruit having a conically mammillate apex. Seed about twice as long as broad.

6. Z. Wallichiana Mart.—Burma, Tenasserim. Mergui Archip., Siam, Indo-China, Malay Peninsula, Penang.

§ § Leaflets having a distinctly sigmoid base, and smooth costæ. Male spikes glabrous. Fruit very suddenly contracted into a long beak.

7. Z. glabrescens Griff.—Malay Peninsula, Penang.

† † Fruit clothed with spreading lanceolate thick subulate scales.

Leaflets straight, lanceolate, having 3 costæ spinulous above. Seed irregularly globular.

8. Z. secunda Griff.—Upper Assam and Mishmee M[ts].

B. Subgenus Leiozalacca.—*Ovary and fruit clothed with appressed scales not produced into a rasping point. Male spadix as in Euzalacca. Female spadix having few female flowers in groups on short branchlets, solitary in the axillas of secondary spathels and not accompanied by neuter flowers.*

Fruit ovoid or obovoid, scales in 24—26 vertical series. Male spadix having elongate branches, bearing short, tomentose, sessile spikes in the axillas of much longer spathes.

9. Z. affinis Griff.—Malay Peninsula, Sumatra.

Male spadix with short spike-bearing branches; spikes glabrous-shortly pedicellate in the axillas of spathes shorter than themselves. Fruit elongate-ellipsoid or ventricose-fusiform, 1-seeded (always ?); scales in 24 longitudinal series.

10. Z. dubia Becc.—Sunda Islands?

Fruit similar to that of *Z. affinis* but with fewer and larger scales in 18—19 vertical series.

11. Z. borneensis Becc.—Borneo.

C. Subgenus Eleiodoxa.—*Fruit clothed with appressed scales not having a prolonged tip. Female spadix with flowers in spikes, two at the axilla of every spathel, one of which is a female, or apparently hermaphrodite, and the other a neuter or a male, without rudiment of an ovary. Fruit normally monospermous. Seed discoid with an upper circular chalazal fovea. Embryo basal. Male spadix not known.*

Leaflets straight.

12. Z. conferta Griff.—Malay Peninsula, Borneo, Bangka.

Leaflets sigmoid.

13. Z. Scortechinii Becc.—Malay Peninsula.

Description of Plate III.

Figs. 1—5. Zalacca (Leiozalacca) affinis *Griff.*—Fig. 1. Young female spikelet ending in a rudimentary flower, and with the fertile flowers just appearing outside their spathels.—Fig. 2. Isolated young female flower furnished with its bracts or spathellules.—Fig. 3. Female flowers during the anthesis enveloped by their spathels

and spathellules.—Fig. 4. Detached female flower during the anthesis.—Fig. 5. Ovary.—All figures enlarged 5 diameters. (*a*=spathel; *b*=outer spathellule; *c*=inner spathellule; *d*=calyx; *e*=corolla).

FIGS. 6—15. Zalacca (Euzalacca) Blumeana *Mart.*—Fig. 6. Spathel shielding two young male flowers accompanied by their bracteoles—Fig. 7. Male flower during the anthesis.—Fig. 8. Vertical section of a male flower.—Fig. 9. Female flower accompanied by its neuter flower and relative bracteoles.—Fig. 10. Portion of the corolla of a female flower open and showing its inner side, and the insertion of the staminodes.—Fig. 11. Female flower entire.—Fig. 12. Female flower divested of its calyx.—Fig. 13. Ovary.—Fig. 14. Neuter flower and its bracteole.—Fig. 15. Diagram of a spathel embracing the female and neuter flower with their bracteoles. All figures enlarged.

FIG. 16. Zalacca (Euzalacca) vermicularis *Becc.*—Longitudinal section of an ovary (enlarged).

FIG. 17. Zalacca (Euzalacca) secunda *Griff.*—Longitudinal section of an ovary (enlarged).

FIGS. 18—21. Zalacca (Eleiodoxa) conferta *Griff.*—Fig. 18. Female flower during the anthesis.—Fig. 19. Female flower cut open.—Fig. 20. Neuter flower.—Fig. 21. Portion of the neuter flower cut open. (All figures enlarged 7 diameters.)

EXCLUDED SPECIES.

ZALACCA BECCARII Hook f. fl. Brit. Ind. vi, 474. Species established on the young fruits of a *Zalacca* (probably of *Z. Wallichiana*) and the leaves of *Calamus longisetus* (I have seen the typical specimen in the Herbarium at Kew).

ZALACCA? ASSAMICA Lodd.=*Plectocomia assamica* Grif. ex Miq. Fl. Ind. Bat. iii, 81.

ZALACCA NITIDA.—Cat. W. Bull. 1886, 9; from West Africa, probably a species of *Raphia*.

ZALACCA WAGNERI Hort. Versh. ex H. Wendl. in Kerch. Les Palm. 258, nomen—Quid?

DESCRIPTIONS OF SPECIES.

1. ZALACCA EDULIS Reinw. (Salacca) in Sylloge Plant. Soc. Ratisb. ii, (1828), 3 ex Blume (*Zalacca*) in Roem. et. Sch. Syst. Veget. vii, p. 2—1334; Kurz in Natuurk. Tijdschr. Ned. Indie. xxvi, (1864) 217; Miq. Fl. Ind. Bat. iii, 81.

Fructus squamosus pyriformis Clus. Exot. Lib. ii, c. 4, p. 25—26 cum icone.

Baly insulae fructus pyri forma asper. C. Bauh. Hist. i, cum icone.

Calmus Rotang VAR. *θ*, Linn. Sp. 463.

Description.—Cæspitose, almost stemless. *Leaves* interruptedly pinnate; rhachis armed along the dorsum with a line of large flattened spines, and spinous also at the sides in its basal part. *Leaflets* bifarious, all in one plane, often several one after the other equidistant, but at times leaving long vacant spaces of rhachis interposed, narrowly lanceolate, slightly sigmoid or falcately acuminate, terminating in a filamentose tip, green, almost glossy above, and ashy gray beneath. *Male spadices* (or their primary divisions?) 40—55 cm. long, forming lax, nodding (or trailing?) subsecund panicles, composed of few (5—6) slender, alternate, superposed branches, 10—20 cm. long, each supporting a single spike. The primary spathes are lanceolate-acuminate, of a soft structure, thinly rusty-tomentose, splitting longitudinally and finally decomposed into long fibres; the spike-bearing branches are tomentose, each furnished with two special spathes, one placed midway, the other just at the base of the *spikes.* The *spikes* are flexuose, 12—15 cm. long, 10—12 mm. in diameter, entirely exserted from the spathes. The spathels are rusty-furfuraceous outside, and at first, when the flowers are very young, united together so as to form very regularly superposed, approximate rings, having only the rim slightly interrupted by obtuse but distinct points corresponding to every insertion of flowers; in this stage the spikes are vermiform and almost smooth, but when the flowers appear, the spikes assume a squarrose and toothed appearance, owing to the rings becoming slightly gaping and more or less split into as many parts as theoretically there ought to be spathels, and each part being terminated by a triangular point. The *male flowers,* just before opening, are narrow, 6—7 mm. long, 2·5 mm. broad, and slightly protrude above the spathels; the calyx is as long as the undivided part of the corolla and is parted nearly to the base into 3 linear, hyaline segments; the corolla is parted in its upper third into 3 triangular acute segments, spreading during the anthesis, and is fleshy and tapering below; the stamens are all equal, have the filaments subulate and spreading during the anthesis, and the anthers lanceolate-sagittate; the rudimentary ovary is extremely minute and placed only a little above the base of the corolla; the special floral bracts are very narrow, shorter than the flowers and slightly hairy-paleaceous. The *female spadix* is probably very much like that of *Z. Blumeana.*

Habitat.—Native of the Malay Islands, but the precise place of origin not known. Frequently cultivated.

Observations.—Reinwardt assigned the name of *edulis* to that species of the genus *Zalacca,* known to the ancient authors (Clusius, Rumphius, and Gaertner) in the belief that all those writers had in mind the same species, characterized by the spinuliferous fruits; but this kind of fruit occurs in several distinct, although allied species, dispersed throughout the various Malay islands. It happened therefore that under Reinwardt's name of *Z. edulis* (and that of *Zalacca* of Rumphius) more than one species was included.

The first notice of a *Zalacca* is found in the works of Clusius (l. c. 1605), who describes and figures, under the name of *Fructus squamosus pyriformis,* certain fruits that in his time had reached Europe from Bali, preserved in brine. These fruits from Bali ought to be considered as representing the typical *F. edulis,* and if they could be now obtained, accompanied by spadices and leaves, the question as

to the identification of that species could be settled at once; otherwise it is hopeless to rely for its sure identification on the description and figure given by Clusius. Rumph was the first to adopt the Malay name of *Zalacca* for the same *Fructus squamosus pyriformis* of Clusius; and he also gives a description and a bad representation of that plant, stating that it grows not only in Bali, but also in the western part of Java; adding that in old times it was thence introduced into the Islands of Banda and Amboina. We are therefore justified in considering Rumph's *Zalacca* as a complex species, that includes also the Javan *Z. Blumeana*. It is however more by conjecture than by the evidence of facts that I assume to belong to the true *Z. edulis* the plant cultivated at Buitenzorg, described by me above, which was introduced from Amboina, and produces male spadices widely different from those of *Z. Blumeana*, but which from the affinity it presents with the allied species, certainly must produce fruits very much like those of the *Fructus squamosus pyriformis* of Clusis.

Z. edulis, as conceived of by me, is especially characterized by the male spadices quite different from those of *Z. Blumeana* Mart., and resembling those of *Z. vermicularis* Becc. In *Z. edulis* the male spikes are long and flexuose, entirely exserted from the spathes; the floral bracts are furnished with very little wool and that not visible outside; the spathels during the anthesis are slightly gaping and have very broad but distinct triangular points, which on the whole give a squarrose or toothed appearance to the spikes; the flowers are small, slightly protruding beyond the spathels, and have the corolla divided in its upper third into 3 triangular segments, spread open during the anthesis.

PLATE 42.—Zalacca edulis *Reinw.*—Portion of a leaf near the end. Male spadix bearing, specially in their upper part, young spikes with the flowers still hidden within the spathels; branch of the male spadix with spikes during the anthesis. From a plant cultivated at Buitenzorg (V. G. 21 a).

1*a*. ZALACCA EDULIS *var.* AMBOINENSIS Becc.

Zalacca (Rottang Zalack), Rumph. Herb. Amb. v, 113, t. 57, f. 2.

DESCRIPTION.—A note of the collector (C. B. Robinson) says that "the plant has leaves over 4 m., with 35 pairs of leaflets or more, often irregular, either wanting or else represented by spines. Fruit yellow brown." In my specimen the *leaflets*, in a portion of rhachis 30 cm. long, are equidistant, 60 cm. long, 3·5 cm. broad, linear, very slightly sigmoid at the base, and briefly falcate at apex, ashy or rusty-grey beneath. A *female fruiting spike* is very similar to those of *Z. Blumeana*, but judging from the remnants of the flowers found upon those spikes, the *female flowers* have very thick, oblong, obtuse, tongue-like stigmas. The *fruit* is globose and narrows abruptly at the base; the scales have as usual an up-curved spinulous tip, but are broadly grooved on the posticous part, and only slightly keeled at the apices. The seeds have a very abundant fleshy integument, which even in the herbarium specimens remains acid, and has the flavour and consistence of dried plums; when divested of the integument the nucleus shows a dark brown

and even surface, is very irregularly and obtusely subtrigonous, or at times almost globular, 15—16 mm. in diameter, and has an apical pit and a large basal embryo.

Habitat.—Amboina. The specimens of this distinct variety (or perhaps species) were collected on the 23rd August 1913 at Kusy-Kusy Sereh by the late *C. B. Robinson*, and one of them was forwarded to me by Mr. Merrill of the Manila Herbarium.

Observations.—The specimen upon which this variety is established differs from those of the plant cultivated at Buitenzorg (considered as representing the type of *Z. edulis*) in its leaves, which are much narrower and more regularly set on the rhachis. Of this Amboinese *Zalacca* the male spadices are unknown, and of the supposed type the fruits are wanting; so it is possible that when the two shall be better known, they may be found not to be specifically identical. The plant collected by Robinson can be only be considered as partially representing Rumph's *Zalacca*.

Plate 43.—Zalacca edulis var. amboinensis *Becc.*—Portion of the petiole and of the intermediate part of a leaf; spadix bearing young fruits; mature fruits and seed. The entire specimen in Herb. Beccari.

1*b*. Zalacca edulis *var.* riowensis Becc.

Description.—It differs from the plant considered as the type by the male spadices being much shorter, only about 25 cm. long, having the branchlets supporting the spikes also shorter; but otherwise it is in every respect, even in its leaves with their unequidistant leaflets, white underneath, not distinguishable from the type. The petiole is very powerfully spinous.

Habitat.—It was cultivated in the Botanic Garden at Buitenzorg and said to have been introduced from Riow; I gathered my specimens of it in the year 1878.

Plate 44.—Zalacca edulis var. riowensis *Becc.*—Lower portion of a leaf and petiole; fragment of a leaf from above the middle. Male spadix. Specimen in Herb. Beccari from the plant cultivated at Buitenzorg mentioned above.

3. Zalacca vermicularis Becc. Malesia, iii, 66.

Description.—*Leaves* very large. *Leaflets* (alternately equidistant?), coriacious, green and glossy above, dull whitish or ashy grey beneath; the intermediate very broadly linear, slightly sigmoid at the base, asymmetrically acuminate and slightly falcate at the apex, up to 90 cm. long, and 7—8 cm. broad, strongly tricostulate; the transverse veinlets sharp and very approximate. *Male spadices* (or perhaps only their primary branches) arising erect from the axillas of the leaves, about 35 cm. long, forming a rather loose cupressiform panicle, composed (in 2 specimens) of only 7 alternate branches, each arising from a broad, acuminate, embracing spathe, and bearing only one spike. The general spathes are concave, elongate, acuminate, and ass-ear like, thinly membranous, easily splitting longitudinally,

thinly rusty furfuraceous, the lowest 12—15 cm. long. The branches are about as long as their respective spathes, which have a narrow tubular lower part, and rather abruptly expand into a broadly and loosely infundibuliform limb, produced at one side into a triangular acute point; the branches are inserted at the bottom of their respective spathes, are about as long as these (5—7 cm.) form a pedicel to the spikes and are enveloped by 2 other minor spathes. The *spikes* are entirely exserted from the spathes, vermiform, erect, slightly flexuose, 8—12 cm. long, 10—11 mm. broad, and narrow a little above to a rather acute point; the bracts of the spikes or spathels are united together and form very regular superposed rings, having the rim truncate, but showing an obtuse point, to which converge several distinct nerves in correspondence with every insertion of flowers. The special flower-bracts are linear and bear at their apices dense tufts of rusty-woolly hairs covering the flowers before the anthesis, which afterwards remain visible outside the rim of the spathels, and give to the entire spikes a tomentose appearance. *Male flowers* small, about 5 mm. long; the calyx at first entire, later split into 3 hyaline striate segments; the corolla slightly longer than the calyx, three-parted nearly to the middle, tapering and fleshy below with the segments ovate, rather acute, and spreading during the anthesis; stamens subseriate, 3 of them being longer than the others; filaments subulate, recurved during the anthesis; anthers almost orbicular or a trifle longer than broad *Female spadix* shorter than the male, formed by a very few, closely packed, short branches, each bearing 1—2 almost sessile spikes, and altogether forming a large, dense and almost sessile mass, enveloped by several spathes broadly lanceolate, long-acuminate and rusty-pulverulent outside, of which the lower and larger are 35—40 cm. long, all speedily split into long criniform fibres. The flowering *spikes* are thick and shortish, 8—10 cm. long, and 2·5 cm. broad, torulose, apiculate; the spathels are relatively large, at first connate and truncate, later split, thinly rusty-furfuraceous outside, each shielding a female flower accompanied by a neuter one. Special floral bracteoles rigid-subcoriaceous; the internal one broadly triangular, the two external narrow, densely covered on their keeled backs with rusty-paleaceous hairs. *Female flowers* relatively large, ovoid-oblong, 12 mm. long, 6·5—7 mm. broad, slightly curved; the calyx more or less deeply 3-lobed at first, then split into 3 very thin membranous, soon decaying, oblong, acute segments, about as long as the corolla. The corolla coriaceous, striately veined outside, trigonous-pyramidate in its upper part, and divided to about the middle into 3 triangular acute teeth, ventricose in its lower undivided part; the staminodes are rigid, subbiseriate, and have small rudimentary anthers; ovary ovoid, narrowing to a thick and relatively rather elongate style; stigmas thick, tongue-like, blunt, relatively large. *Neuter flowers* as long as the female ones, curved, of a general clavate form, tapering quickly to at a very narrow acute base from an acutely trigonous-pyramidate upper part. Fruit (seen only at a very young stage) covered with black shining spiculæ.

HABITAT.—Borneo. In the primeval forest of Sarawak in most fertile soil in ravines at the foot of Mt. Mattang (*Becc.* P. B. No. 2011).

OBSERVATIONS.—Apparently it greatly resembles in its female spadix and fruit *Z. Clemensiana* and *Z. Blumeana*, but it is distinguishable from these by its male

spadices (or primary branches) composed of a few superposed short branches, each bearing one spike only, and forming on the whole relatively small cupressiform erect panicles; by the male spikes having the spathels connate in very regular superposed annular rings, the one closely appressed to the other, having the rim quite truncate and not showing any projecting tips corresponding to the place of the flowers; by very small male flowers, having the segments of the corolla quite horizontally spread out during the anthesis; and by the rather elongate style with tongue-like stigmas.

PLATE 45.—Zalacca vermicularis *Becc.*—Intermediate portion of a leaf. Male spadix. Female spadix with young fruits. From Becc. P. B. No. 2011.

3. ZALACCA BLUMEANA Mart. Hist. Nat. Palm. iii, 202 (first edit.) and 201 (2nd edit.) t. 123 and 159, iii; Becc. Malesia, iii, 65.

Calamus Zalacca Gaertn. De Fruct. et Sem. ii, 267, t. 139 f. 1.

DESCRIPTION.—Stemless and not differing in general appearance from the allied species. *Leaves* interruptedly pinnate; the rhachis armed along the dorsum with a line of large flattened spines, and spinous also at the sides in its basal part. *Leaflets* in groups of 2 to 4 on each side of the rhachis in its lower part, with long vacant spaces interposed, more regularly bifarious towards the end; in each group the leaflets are regularly set and all in one plane (not pointing in different ways), narrowly lanceolate, slightly sigmoid, falcately acuminate and with filamentose tips, green and almost glossy above, ashy grey beneath, all distinctly 3-costulate in their basal part, the mid-costa alone much raised throughout and spinulous only near the apex on the upper surface; the side costæ more slender than the mid one, smooth and evanescent upwards; the intermediate leaflets are 50—60 cm. long, 5—5·5 cm. wide; the upper ones somewhat shorter; the uppermost more or less united and less acuminate; the margins appressedly spinulous from about the middle upwards. *Male spadices* (or its primary divisions?) 40—50 cm. long, forming a rather dense, cupressiform, erect panicle, composed of a few erect, very short, and approximate branches, each of which supports 1—2 spikes only, and is furnished with 2—3 special spathes which envelope their respective spikes. The primary spathes are fusiform or lanceolate, acuminate, concave, ass-ear like, of flabby structure, thinly tomentose, splitting along one side, and finally end in long fibres. The *spikes* are borne on a very short pedicel, with their apices at about the same level as their own spathes or protruding a little beyond them. are finger-like, straight, erect, 12 cm. long, 18—20 mm. thick at the time of flowering; the spathels are of a thin structure, strongly striately veined, at first completely connate by their margins forming truncate rings, but separating later into distinct divisions, each division being terminated by a broad obtuse furfuraceous point, in correspondence with the insertion of the pairs of flowers; special floral bracteoles linear, very slender, hairy, paleaceous at their summits and on the keeled back. *Male flowers* very closely packed, entirely concealing the spathels during the anthesis, apparently all opening at one time; the full grown buds are 7 mm. long, clavate with a round top, 3 mm. broad, greatly attenuated to a narrow base; the calyx is elongate, deeply divided into 3 broadly

linear, hyaline, striately veined segments, rounded and cucullate at apex; the corolla slightly longer than the calyx is divided from a little above the middle into 3, oblong, cartilaginous segments, rounded at apex, and finely striate externally; the lower undivided part of the corolla is fleshy; the segments are slightly divaricate during the anthesis but not horizontally spread out; the stamens are uniform, inserted in the throat of the corolla, have the rigid, erect, subulate filaments thick at their base, where connate with the tubular part of the corolla; anthers erect, basifixed, oblong, obtuse, their cells briefly disjointed at the base; rudiment of the ovary obsolete or extremely minute, placed just at the bottom of the corolla. The *female spadix* is shorter than the male, and formed by a few very closely packed short branches, each bearing 1—2 almost sessile spikes, and the whole forming a large and dense, almost sessile mass, enveloped in several spathes. In the specimens seen by me the primary branches carry only one spike, shortly pedicelled, enveloped in spathes longer than their respective spikes, similar to those of the male spadix and soon breaking up into long criniform fibres. The flowering *spikes* are torulose, 8—10 cm. long, and 2—2·5 cm. in diameter; the spathels are, at first, connate by their margins but soon separate and assume a broadly trapezoidal shape with a short triangular point in the middle of the upper margin; are concave, papyraceous, brown, strongly striately veined, finely rusty-tomentose, and finally marcescent and split up into fibres; at every insertion point is a female flower accompanied by a neuter one. The *female flower* is provided with two special bracts, one of which is placed between it and the neuter, and is large triangular, acuminate, membranous, and embraces the base of its flower; the other or external bract is narrow, and slightly hairy-paleaceous on its keeled dorsum. The *neuter flower* is 10 mm. long, very slender, more or less angular, and diminishing considerably below to a narrow base; it is also provided with a bract similar to the external one of the female flower; the calyx is formed by 3 lanceolate, hyaline, keeled sepals united by their bases; the corolla is coriaceous and with its triangular acuminate connivent segments assumes a trigonous-pyramidate form; its base is solid, elongate and narrow; the stamens are reduced to rigid slender filaments, ending in rudimentary subulate anthers. *Female flowers* are relatively large, almost regularly ovoid, have a broad round base, and a conical acuminate point, are 12 mm. long, and 7—8 mm. broad; the calyx is, at first, more or less deeply 3-parted; later it splits down to the base into 3 very thinly membranous, speedily decaying segments, triangular from a broad base and acuminate, appressed to the corolla, and shorter than it; the corolla is coriaceous striately veined outside, trigonous-pyramidate above, divided to about the middle into 3 elongate triangular teeth or segments, and globular-ventricose in its lower undivided part; staminodes 6, slender, rigid, bearing narrowly lanceolate acuminate rudimentary anthers; 3 of them stand erect in the sinuses between the teeth of the corolla, and 3 are opposite the teeth and are inserted at a lower level; ovary ovoid, narrowing above to a short and thick style, and covered densely with dark ascendent spiculæ; stigmas trigonous, elongate, spreading. *Fruit* turbinate or broadly pyriform, having a globular obsoletely trigonous upper part, speedily tapering below to an acute base; it is about 4 cm. long and 3·5 cm. broad; scales glossy, of a dark chestnut brown colour, squarrose, slightly convex and faintly keeled along the centre, and arranged in very numerous longitudinal series, their apices produced

into very fine upcurved brittle points, 4—5 mm. long; the remnants of the style form, on the round top of the fruit, a small mucro about 3 mm. long, surrounded and entirely hidden by the erect spinules of the uppermost scales. *Seeds* 3; when divested of their fleshy integument roundish subtrigonous, 2 cm. long, 15—18 mm. broad, 10—12 mm. thick, rounded above, narrowing towards the base, convex on the back and having two flat facets inclined at a wide angle on the inner side and an apical pit, corresponding to a narrow intrusion of the integument, about 8 mm. deep; the embryo is basal, exactly in opposition to the apical pit, and about as long as the intrusion of the integument.

Habitat.—The specimens from which the above description has been drawn up, are derived from plants cultivated in the Botanic Garden of Buitenzorg (V. Y. 8 the fruit; V. Y. 8a the male spadix), but apparently introduced into the Garden from its neighbourhood, where this species seems to be either spontaneous or occasionally planted.

Observations.—It is characterized with certainty by the male spadices short, cupressiform, having few approximate secondary branches, each bearing only 1—2 finger-like thickish spikes, shorter or else slightly longer than their respective large fusiform spathes; by the same spikes having the flowers very closely packed together, completely hiding the spathels, and by the segments of the corolla slightly divaricating during the anthesis, and not completely spread out; by the leaves having the leaflets ashy grey beneath, interruptedly pinnate, but with the leaflets in each group regularly bifarious and not pointing in different ways. It seems also to differ from the allied species by the fruit, which is not much prolonged at the base, and has subtrigonous seeds, convex on the dorsum.

The fruits of *Z. Blumeana* represented in Martius's plates 123 and 159 III, show the scales not prolonged into subspinous upcurved points, doubtless because, being very brittle, they had been rubbed off before the artist saw them. *Calamus Zalacca* Gaertn. is, I think, referable to *Z. Blumeana* Mart., and is not the plant of Clusius (*Z. edulis* Reinw.), especially on account of the relatively scanty, although fleshy, but later dry integument, with which the seeds of *Z. Blumeana* are covered (demum exarescens—Gaertner); whereas in *Z. edulis* the integument is copious and never becomes absolutely dry.

Plate 46.—Zalacca Blumeana *Mart.*—Male spadix. Portion of a leaf near the end. Spike with mature fruits. One fruit open showing 2 seeds in situ, one having been taken out; one seed, dorsal aspect. From plants cultivated at Buitenzorg (V. Y. 8 d, and V. Y. 8). Specimens in Herb. Beccari.

Zalacca Blumeana *var.* Rimbo Becc. var. nov.

It differs from the type only in the fruit being almost globular and only very slightly attenuate at the base. The fruit contains 1 to 3 seeds, which of course vary in shape according to their number, are globular when solitary, convex on the back with flat ventral surfaces when two, and have two flat inner facets when 3 in number, otherwise as in type.

HABITAT.—It has been quite recently (1915) collected by Mr. *Grashoff* at Mulah Ulu, Prov. of Palembang, in S.-E. Sumatra. It was however cultivated in the Botanic Garden at Buitenzorg (V. G. 14), but its place of origin was unknown.

PLATE 47. Zalacca Blumeana VAR. Rimbo *Becc.*—Female spadix during the anthesis; detached female spike; spike with mature fruits; intermediate portion of a leaf. From a plant cultivated at Buitenzorg (V. G. 14) in Herb. Beccari.

4. ZALACCA SUMATRANA Becc. n. sp.

Z. Wallichiana (non Mart.) Miq. Prodr. Fl. Sum. 255,592.

DESCRIPTION.—Stemless as usual. *Leaves* very large. Petiole very densely armed with very unequal spines, some short, a great many large and very robust, subulate, flattened, schistaceous, frequently approximate by their bases and obliquely inserted. Rhachis stout, trigonous, armed only along the dorsum, especially in its lowest part, with a line of large flattened spines, 3—5 cm. long, 5—10 mm. broad at their bases, frequently accompanied by smaller ones. *Leaflets* numerous, all equidistant and regularly bifarious in one plane (in one specimen) narrowly lanceolate, slightly sigmoid at the base, having a falcately acuminate tip, and parallel margins in their intermediate part, rigid, green and glossy above, dull and ashy grey beneath, all very conspicuously 3-costulate, the costæ being very robust in their basal parts, more slender, but yet present also towards the apex; the mid-costa is spinulous only near the apex; the margins are appressedly spinulous in their upper part; the intermediate and largest leaflets are 70—75 cm. long and 6—7·5 cm. wide; those towards the end are gradually shorter but not narrower; the uppermost are partially united and less acuminate than the others. *Male spadix* ......*Female spadix* apparently dense and short, very similar to that of *Z. Blumeana*; one spike is about 12 cm. long (not taking into account the fruits it carries). *Fruit* turbinate-obpyriform, 6—7 cm. long, having a globular head 4—4·5 cm. in diameter, which gradually tapers to a long very narrow base; scales glossy, of a dark chestnut brown colour, squarrose, arranged in very numerous longitudinal series, (I counted 45 on one fruit), keeled along the centre, the apices produced into very fine upcurved brittle points, 4—6 mm. long. The remains of the style form on the round top of the fruit a small terete mucro, 4 mm. long. The *seeds*, usually 3, have an abundant fleshy acid integument completely filling the cavity of the pericarp; when divested of the integument they are irregularly and obsoletely trigonous, broad above and more or less narrowing below, often somewhat flattened, 2—2·5 cm. long, 15—19 mm. broad, with a dull dark brown even surface, and an apical pit corresponding to a narrow intrusion of the integument 8 mm. deep; the embryo is basal, triangular acuminate, also about 8 mm. long, set exactly in opposition to the apical pit.

HABITAT.—The description of this supposed new species is derived from specimens gathered by me in August 1878 in S. W. Sumatra at Ayer Mantjor (360 m. above the level of the sea) in the Prov. of Padang. In "Malesia" (vol. III, p. 64) I had referred these specimens to *Z. edulis* Reinw. and erroneously given the locality of Kayu tanam, which indeed is not far distant from Alyer Mantjor.

Probably to this "supposed" species is referable a specimen collected by Teijsmann at Priaman, also in the Province of Padang (No. 2029 in Buitenzorg Herbarium and labelled *Z. Wallichiana* Mart.; which certainly is the species so named by Miquel l. c.

OBSERVATIONS.—It is one of the forms which are to be grouped with *Z. edulis* Reinw; but I remain somewhat uncertain about its value, its male spadix not being known, because in the group to which it belongs, the different species are very much like each other as to the fruit, whereas the male spadices and the male flowers afford good diagnostic characters.

Z. sumatrana is apparently distinguishable from *Z. Blumeana* and *Z. edulis* by the leaves having regularly alternately arranged and equidistant large elongate leaflets; by the rhachis being spinous only along the dorsum; but principally by the fruit having a long and narrow tapering base; also by the obsoletely and irregularly angular seeds, broad and somewhat flattened, rounded above, and attenuate below; and by the scale distinctly keeled along the centre.

PLATE 48.—Zalacca sumatrana *Becc.*—Intermediate portion of a leaf; one spike with some of its not quite mature fruits; two entire fruits; two fruits open, showing the seeds "in situ" enveloped in their integument; seeds divested of the integument; one cut through the embryo and the apical pit. The type specimen in Herb. Becc. The fruits were preserved in alcohol.

LATIN DIAGNOSIS. Zalacca sumatrana *Becc.* sp. nov. Frondium segmentis amplis, valde elongatis, regulariter et alterne aequidistantibus, rachi tantum in dorso spinosa; fructibus obpyriformibus, basi longe angusteque attenuatis; seminibus anguste oblongis et irregulariter obtuseque angulosis, apice rotundatis, basi attenuatis.

5. ZALACCA CLEMENSIANA Becc. Notes on Philip. Palms in Philip. Journ. Science (Botany) iv, (1909), 618.

DESCRIPTION.—*Leaves* very large, 5 or more metres long, the petiolar part densely armed with large, broad-based, long spines; rhachis in the intermediate portion acutely trigonous, with a line of long spines along the centre beneath. *Leaflets* interruptedly fasciculate; the fascicles in the intermediate portion usually alternate and formed by 3 or 4 leaflets on each side of the rhachis, somewhat pointing in different ways, elongate-lanceolate, rigidly papyraceous, green and shining above, ashy-coloured beneath, slightly sigmoid at the base; the apex briefly falcate, abruptly and asymmetrically tapering into a long filamentose tip; the margins minutely spinulous from the middle upwards; transverse veinlets very sharp and prominent on the upper surface, much less visible on the lower; the mid-costa prominent and smooth on both surfaces; the lower and intermediate leaflets about 60 cm. long and 6—7 cm. wide, distinctly 3-costulate; upper leaflets smaller and with the side costæ slender and evanescent upwards; the leaflets of the end more distinctly falcate and more sigmoid than the others, and more or less united. *Male spadices* arising erect from the axillas of the expanded bases of the petioles, 60—90 cm. long, inclusive of a short pedicellar part, and bearing 5—7 branches, the one above the other, 5—8 cm. apart,

each bearing several (5—8) alternate spikes. Primary spathes longer than their respective spike-bearing branches (20 cm. long), thinly rusty-tomentose marcescent, and much lacerated or split along one side and reduced to strips and filaments. *Male spikes* cylindraceous, slender, 5 to 7 cm. long, 10 to 11 mm. broad, borne on a very short pedicel, which is embraced by a short and broad membranous bracteiform secondary spathe; the spathels or bracts of the spikes are bracteiform, concave, very broad, acute and striate, individually distinct and not united together so as to form annular involucres (at least at the flowering time), and invisible from the outside even when the flowers are very young; bracteoles densely woolly ramentaceous. *Male flowers* (pink, at least, when young—Elmer) small, 5 mm. long, protruding above the spathels by the full length of the corolla; calyx at first entire, later split into 3 hyaline, striate segments; the corolla is not much longer than the calyx, three-parted nearly to the middle, attenuate and solid below; its segments ovate, subacute, spreading during the anthesis; stamens all of the same length; filaments thickish with subulate apices, curved outside during the anthesis; anthers oblong, obtuse. *Female spadices* apparently shorter than the male ones and having a thicker axial part; one (entire or a branch?) seen by me bears several very approximate sessile spikes, almost hidden by the disintegrated spathes, reduced to fine capillary filaments. The *spikes* are only 3—4 cm. in length, but thickish (15 mm. across), and have relatively few approximate flowers; the spathels have a very broad base and a triangular point, are membranous and strongly striately veined; each embraces a female flower accompanied by a neuter one; bracteoles of the female flower hairy-paleaceous at apex. *Female flowers* ovoid, 8 mm. long; the calyx completely divided into 3 ovate or ovate-lanceolate, blunt, concave, thinly membranous, nearly hyaline, striately veined sepals; the corolla is longer by one-third than the calyx, divided to the middle into 3 semi-ovate-triangular, thickish, acute lobes, and ventricose in the lower undivided part; staminodes stiff, subulate, carrying slender, acuminate, rudimentary anthers; ovary globular-ovoid, covered densely with ascendent spiculæ; style very short; stigmas relatively small, included in the corolla during the anthesis, fleshy and obtuse. *Neuter flowers* rather large, imperfectly formed, 6—7 mm. long, at times not much smaller than their female flowers; the calyx is as in the female flower but narrower; the corolla solid in its lower attenuate part is divided above into three triangular thick segments; the stamens have subulate filaments and small abortive anthers; rudimentary ovary none. The *fruit* not seen by me, but according to Elmer, as reported by the natives, globose and 5·5 cm. in diameter and from the nature of the ovary certainly clothed with scales having upturned spinuliform tips; probably it resembles that of *Z. edulis.*

HABITAT.—The Philippine Islands.—The species was first established on specimens of the male plant only, collected by *Mary Strong Clemens* in June 1907 in Mindanao at Lake Lanao, Camp Keithly (No. 1907 in Herb. Manila and Becc.) Found again also in Mindanao, with male and female spadices by Mr. *A. D. Elmer* at Todaya (Mt. Apo) in the District of Davao (Sept. 1909—No. 11879 in Herb Becc.). Elmer notes that it forms large dense tufts in the moist fertile soil of shallow ravines near streams at about 1000 m.; grows in thickets on the Talon side of the mountain range, and that it is stemless, about 7 to 13 in a cluster.

Observations.—It has the leaflets white beneath and the fruit covered with scales having upturned spinulous tips as in *Z. edulis* and *Z. vermicularis*, but is distinguishable by its fascicled leaflets and especially by the male spikes having the spathels individually distinct, at least at the flowering time, and not connate by their margins so as to form circular rings round the axis—a character which I have not found in any other *Zalacca* known to me.

Plate 49.—Zalacca Clemensiana *Becc.*—Intermediate portion of a leaf; male spadix; separate male spikelets with flowers in bud; female spadix. From Elmer's No. 11879 in Herb. Beccari.

6. Zalacca Wallichiana.—Mart, Hist. Nat. Palm, iii, 201 (1st edit.) 200 (2nd edit.) and 325 pl. 118, 119, 136; Kurz in Natuurk. Tijdschr. Ned. Indie xxvii, (1864), 216: For Fl. Brit. Burma ii, 511; Becc. Malesia, iii, 66; Hook. f. Fl. Brit. India, vi, 473; Ridley, Mat. Fl. Mal. Penins ii, 170.

Z. edulis (non in Reinw.) Wall. Pl. As Rar, iii, 14, pl. 222, 223, 224 (sub-nom. *Z. Rumphii*); Grif. Calc. Journ. Nat. Hist. v. 8: Palms. Brit. Ind. 10, pl. CLXXV (spadix only).

Z. Rumphii Bl. Rumphia. ii, 159.

Z. macrostachya Griff. in Calc. Journ. Nat. Hist. v, 13; Palms Brit. Ind. 15, pl. CLXXVIII, A. B. C.; Mart. l.c. pl. LXXI f. v. 1 (fructus); Becc. l.c.

Description.—Tufted, almost stemless and soboliferous like *Zalacca edulis* and allied species. *Leaves* large, about 5 m. long on the whole, the petiolar part alone being 2 m. or more long, armed with terrible, flattened, long acuminate, rigid, light-coloured, 4—8 cm. long spines, spreading or slightly deflexed, several united by their bases and encircling the petiole with more or less, broken spirals; the rhachis similarly armed in its lower part, but the spines become less numerous as they ascend, and finally solitary above. *Leaflets* distinctly unequidistant, approximated in groups of 2—4 on each side of the rhachis and divergent from their bases in every group, oblong-lanceolate, broadest in their upper third part, above this slightly falcate and abruptly acuminate, terminating in a more or less elongate linear-fili-form tip; below they taper gradually to a rather narrow slightly sigmoid or straight base; they are 3-costulate green and almost glossy on both surfaces, but slightly paler underneath; the mid-costa, though at times slightly spinulous towards the apex, is usually smooth, as are also the side costae; margins spinulous, ciliate from above the middle or thereabouts; the intermediate leaflets are 65—70 cm. long, and 8—9 cm. wide; the upper are shorter and more distinctly sigmoid-falcate; some at the apex are confluent; the lower leaflets are the narrowest and have a more long-acuminate filiform tip than the upper. *Male spadix* coming forth as usual from the axilla of the lower leaves, is elongate, nodding or recurved, branched from the base or divided into several secondary and tertiary flaccid and pendulous spike-bearing branches, 30—80 cm. long; primary spathes elongate-lanceolate, acuminate, covered with a thin

detachable rusty furfuraceus indumentum, lacerated longitudinally. The male spike-bearing branches are covered with thick brown wool, and carry alternately, and at regular distances of 5—7 cm., several solitary spikes, each completely enveloped by a secondary spathe, which is thinly membranous, dry, splitting longitudinally along the axial side, and usually longer than the spike it embraces. The *spikes* have a tomentose appearance, especially before the flowers open; are cylindrical, finger-like, 5—8 cm. long, 12 mm. across, quite sessile and with a round apex. The spathels are connate by their bases, otherwise distinct, very broadly ovate, 4 mm. long; each embraces two flowers and has a broadly triangular acute tip, which only just surpasses the wool of the floral bracteoles, otherwise the spathels are hidden by the wool of the bracteoles; the latter are thinly membranous or hyaline, the lateral connate by their bases, the middle laminar, entire; all villose on their backs, and much more densely so at the apices. *Male flowers* briefly exserted during the anthesis, from the wool of the bracteoles, narrowly clavate, acute (when in bud), 8 mm. long; the calyx at first completely encloses the corolla, but later splits deeply into 3 broadly linear, membranous, subhyaline, obtuse segments; the corolla is slightly longer than the calyx and is divided to about the middle into 3 ovate segments, which have the apices furnished inside with 1—3, very slender, hair-like introflexed appendages, separating the anthers; the latter broadly linear. *Female spadix* composed of several unequal spike-bearing branches, of which some are rather rigid and elongate, and others creeping on the ground. *Spikes* numerous and alternate on the branches, as in the male spadix but larger and with larger flowers, densely tomentose when the flowers are young; later, the flowers being considerably exserted, the tomentum remains covered by the flowers; at the flowering time the spikes are 6—9 cm. long, and 2·5—3 cm. across, and have a very short terminal mucro; the spathels are coriaceous, very broadly triangular and embrace two flowers, one of which is large and female and the other, at its side, much smaller and neuter; floral bracteoles relatively large, the two of the female flower connate at the base, densely villose at the apex. *Female flowers* ovoid-conical; the calyx deeply divided into 3 oblong-ovate, blunt, thinly membranous parts; the corolla somewhat longer than the calyx, divided to the middle into 3 triangular, very acute segments, at first connivent, but spreading during the anthesis; staminodes subulate and with rudimentary anthers; ovary ovoid and densely covered with ascendent spiculae; style short; stigmas lanceolate, rather acute. *Neuter flowers* slender, very much like the male ones, 8—10 mm. long; the stamens have the filaments subulate and bearing slender abortive anthers. *Fruit* obovate pyriform, when thoroughly mature 7—8 cm. long (or at times less?) and 4 cm. across, broadly and rather suddenly conically shaped in its upper third part, and tapering below to a narrow base; scales in very numerous longitudinal series, light-coloured or fulvous, rhomboidal with a subulate spinuliform upcurved brittle tip. *Seeds* 3, oblong, trigonous, convex on the dorsum, about 3 cm. long, the breadth about half as much; the apical intrusion of the integument penetrates more than half way into the albumen; embryo basal, exactly in opposition to the apical pit.

HABITAT.—Frequent in the tropical forests all over Pegu and Martaban down to Tenasserim (*Kurz.*) In Burma at Moulmein (*Meebold* No. 17142 fem. spec.)

and at Mergui (*Meebold* No. 14274. Male specimen in Herb. Breslau); also in Burma at Maytharouk, on the Salween, at 300 m. elev. and on the sea coast at Amherst (*Brandis*). In Siam (*Schomburg* in Herb. Calc.) and at Bangkok (*Pierre* in Herb. Paris). In the Malay Peninsula on the Tahan River in Pahang (*Ridley*) and Permatang Bertam (*Ridley* No. 7003) and at Bukit Juru, Province Wellesley (*Ridley*). Griffith writes of his *Z. macrostachya*, which certainly is the female plant of Z. *Wallichiana*, that it grows "in marshy, damp and exceedingly shady places at Ching near Malacca" and that its spadices are so long as "to reach the ground on which the spike of flowers are frequently to be found, and often immersed in water, which abounds in the favorite localities of this species." It is said to grow also in Penang, Singapore, Sumatra, and Bangka, but I have not seen specimens from these places.

Observations.—Doubtless *Z. macrostachya* Griff. is the female plant of *Z. Wallichiana* Mart., as is easy to verify comparing Griffith's plate CLXXVIII, B. (*Z. macrostachya*) with Martius's plate 119, I (*Z. Wallichiana*), both representing a portion of the female spadix in flower.

To *Z. Wallichiana* also belongs Wall. Cat., No. 5000, male specimen in Herb. de Candolle; in this specimen the spathes are slightly less than twice as long as the spikes. In Kurz No. 3328 in Herb. Calc. the spathes are just twice as long as the male spikes. In Griffith's plate CLXXV the spikes are slightly shorter than their spathes.

In Griffith's plate CLXXV the figure representing a branch of the male spadix really belongs to *Z. Wallichiana*, but in this figure the leaf seems to belong to another species, probably to *Z. affinis*, as its segments are sigmoid and not grouped, as in *Z. Wallichiana*.

Z. Wallichiana is well characterized by its leaves having a long petiolar part armed with spiral interrupted whorls of very large spines; by the leaflets green on both surfaces, oblanceolate, narrowing to a nearly straight base, in groups of 2—4 on each side of the rhachis, and approximated by their bases in each group divaricating and pointing in different directions; in having the mid-costa spinulous above only; by the elongate and nodding male spadices, having long pendulous spike-bearing branchlets; by the sessile ♂ and ♀ superposed distant spikes, enveloped by lacerated spathes, longer than the spikes; by the male spikes tomentose, and by their flowers having the apex of the segments of the corolla provided with introflexed appendages; by the floral bracteoles being densely villose; by the fruit obovate-pyriform, conical in its upper part, and having spinous scales and oblong seeds.

Plate 50.—Zalacca Wallichiana *Mart.*—Portion of a leaf a little above the base; intermediate portion of the petiole; male spadix bearing spikes still young. From a plant cultivated at Buitenzorg (Herb. Becc.). Male spikelet at the moment of the anthesis; from Meebold's No. 14274.

Plate 50A.—Zalacca Wallichiana *Mart.* in the Botanic Garden at Calcutta.

Plate 51.—Zalacca Wallichiana *Mart.*—Portion of a leaf near the apex; portion of a female spadix in flower; the apical part of a spadix with young fruits.

From a plant cultivated at Buitenzorg (Herb. Becc.). Young fruits; from Meebold's No. 14619. One mature fruit, from Amherst (Brandis).

7. Zalacca glabrescens. Griff. in Calc. Journ. Nat. Hist. v, 14: Palms Brit. Ind. 17, t. 179; Hook. f. Fl. Brit. Ind. vi, 473; Ridley, Mat. Fl. Mal. Penins. ii, 170.

Description.—Stemless as usual, but apparently a smaller plant than the allied species. *Leaves* 2–3 m. long (at times more ?); the petiole, 1·25 m. long in one specimen, is in its lower part obtusely trigonous and armed with a few interrupted rows of confluent, robust straight spines, 4–5 cm. long; upwards it is terete and with the spines solitary, scattered and very unequal above and along the centre beneath; the rhachis in its first portion is more or less armed on the dorsum with a line of straight, rigid, horizontal or ascendent spines, and has a deep furrow on each side of the median ridge above; upwards it is trigonous. The *leaves* of young plants have the petioles (when dry) trigonous, and the leaflets equidistant from the middle above; in full grown plants the leaflets are all on one plane, very plainly interrupted, two or three being approximated on each side of the rhachis, with long vacant spaces between the groups, at least from the middle downwards; are thinly papyraceous green and almost glossy on both surfaces, distinctly sigmoid-lanceolate, broadest about their middle, and thence tapering downwards to a rather acute base, and narrowing upwards to a falcate, subulate, filiferous or cirriform apex; have 3 slender costae, acute and smooth; transverse veinlets not very approximate (2–3 mm. apart); margins spinulous, ciliate only near the apex: the intermediate leaflets are 30—35 cm. long, and 5–6·5 cm. wide; the lowest are somewhat longer, but only 3–4 cm. wide; the uppermost are confluent and form a bilobed flabellum, the lobes being deeply 4–5 cleft. *Male spadix* branched from the base, forming a panicle 25—40 cm. long; primary spathes very short, subcoriaceous, thinly rusty tomentose; spathes of the branches 7—10 cm. long, rigid, tubular and narrow in their basal part, unclosed on the ventral side and broadening above into a lanceolate, acuminate, papyraceous, fugaciously furfuraceous limb; the lower branches bear 3—5 spikes, the upper ones only one or two; the spikes are supported by a pedicellar rusty furfuraceous part which is itself provided with a secondary rather large, loosely infundibuliform spathe, prolonged into a lanceolate limb. The *spikes* are entirely exserted from the spathes, 4–9 cm. long; when young are vermiform and glabrous, looking as if they were regularly formed by superposed rings, one into the other, later have a subsquarrose appearance, and when covered with full grown flowers are 13 mm. in diameter; spathels united by their bases, forming the rings spoken of above and having the rim undulate and very obsoletely toothed, each tooth corresponding to a bract; special flower-bracteoles slender, shorter than the spathels and slightly hairy-paleaceous. *Male flowers* small, 5–6 mm. long, produced beyond the spathels only during the anthesis with the spread out lobes of the corolla; the calyx splits into 3 linear hyaline segments, as long as the lower fleshy entire part of the corolla, which is divided, in its upper third into 3 oblong segments; rudimentary ovary basal, very small but distinct; stamens equal, their filaments subulate from a thickish base; anthers oblong. *Female spadix* consisting of only a few branches, 15—30

cm. long, clothed with several spathes similar to those of the male spadix, each bearing a solitary long-pedunculate nodding spike, 7—8 cm. long, 2 cm. in diameter and terminated by an apiculum, formed by small approximate much reduced spathels ; the normal spathels are very broad, coriaceous and connate by their margins. In correspondence with every spathel are, as usual, two flowers, one of which is large and female, the other at its side, is smaller and neuter. *Female flowers* obliquely ovoid, 8 mm. long; the calyx splits into 3 oblong, blunt segments ; the corolla, about one-third longer than the calyx, is divided to the middle into 3 thickish triangular segments ; sterile stamens are present ; ovary strigose ; style short ; stigmas thick, elongate, trigonous ; special female flower bracteoles thickish, ovate, slightly hairy but only on the keeled back. *Neuter flowers* not seen in good condition by me, described by Griffith as having 6 barren stamens, small sterile anthers and an ordinary rudiment of the ovary within the attenuate base. *Fruit* (immature) broadly ovoid (when mature globose, Hooker), 2—5 cm. in diameter, suddenly contracted into a columnar beak 12—15 mm. long, 6—7 mm. thick, and terminated by the small remains of the style and stigmas ; the more developed fruits seen by me were 53 mm. long (including the beak) ; the beak of the fruit is clothed like the body with dark brown, rhomboidal, slightly convex, obtusely keeled scales, arranged in numerous vertical series, and having a recurved, ascendent, setose tip.

Habitat.—The Malay Peninsula : Penang (*Lewes* ex *Griffith* and No. 2435 ex Hooker), Penang Hill, Road to Balik Pulau (*Curtis* ex *Ridley*) : in the District of Perak (*Scortechini* in Herb. Beccari) : in Selangor ; Kwala Lumpur, Ulu Selangor (Ridley). Pahan : Tahan River Woods (*Ridley.*)

Observations.—Easily distinguishable, by its leaves having unequidistano, more or less distinctly grouped, sigmoid, concolorous leaflets ; by the male flowers being provided with very slender, very slightly woolly bracteoles, and consequently by the male spikes having a glabrous aspect ; by the branches of the female spadix bearing a solitary spike ; but especially by the fruit terminating very abruptly in a long and narrow beak.

I was mistaken (Malesia, iii, 64) in referring this species to *Z. edulis.* The description above is based mainly upon Scortechini's specimens.

Plate 52.—Zalacca glabrescens *Griff.*—Male spadix having some of the spikes with flowers very young ; in the other the flowers are ready to expand ; two spikes at the flowering time, intermediate portion of a leaf. From Scortechini's specimen in Herb. Beccari.

Plate 53.—Zalacca glabrescens *Griff.*—Intermediate portion and lower part of a leaf, with a good portion of the petiole ; female spadix (or a portion of it) ; ovaries and young fruits in different degrees of development. From Scortechini's specimen in Herb. Beccari.

8. Zalacca secunda Griff. in Calc. Journ. Nat. Hist. v, 12 ; Palms Brit. Ind. 14 pl. CLXXVII ; Becc. Malesia, iii, 67 ; Hook. f. Fl. Brit Ind. vi, 472.

Calamus collinus Griff. Palms Brit. Ind. p. CLXXXVI (leaf only).

DESCRIPTION.—Nothing is known about the general habit of this plant, but apparently it is less armed with spines than is usual with its congeners. *Leaves* very large, 10 m. long (Mann); the petiole is covered fugaciously with a very minute, rusty pulverulent indumentum, is terete in its upper part, and is armed like the lower part of the rhachis, but only on its back, with a few slender, needle-like, fasciculate spines, 2–3 cm. long; the rhachis is, in its lower part, rounded on the back, and has above two longitudinal furrows for the insertion of the leaflets; higher up it is trigonous, and quite unarmed. *Leaflets* in groups of 2–3 on each side of the rhachis in its lower part, regularly alternate above, straight (not sigmoid nor falcate), narrowly lanceolate, almost equally diminishing from the middle towards both ends, very gradually acuminate above to a very acute and (in the lower leaflets) filamentose tip, equally green and almost shining on both surfaces, acutely tricostulate, the 3 costae bristly-spinulous on the upper surface from about the middle upwards, smooth beneath; margins appressedly bristly-spinulous above the middle; transverse veinlets very slender and sharp, extremely numerous and approximate; the intermediate leaflets 85–90 cm. long, 6·5–7 cm. wide, the lowermost shorter and narrower, the upper gradually smaller and less acuminate; all free, except the two of the apex, which are the smallest and are united by their bases. *Male spadix* rather large with a robust axial part bearing at different levels several spike-bearing branchlets. Primary spathes covered with a thin, soft, rusty, detachable indumentum, tubular in their closed basal part, unclosed lanceolate-acuminate and partly clasping above. The spike-bearing branches flaccid, nodding or recurved, up to 1·3 m. long or shorter, divided into smaller branches in their lower part, and bearing several spikes. The *spikes* have in general an alternate secund arrangement, and come forth solitary from the mouth of a secondary spathe, are 6–7 cm. long, and 14–15 mm. across, are supported by a slender elongate pedicellar part as long as or a little longer than the spathes and itself sheathed by several infundibuliform tertiary spathes. The secondary spathes have a tubular base, and a lanceolate-acuminate and lacerated limb. The spathels of the spikes are united by their bases, but have a bractei-form, deltoid, very obtuse, free limb. *Male flowers* 8 mm. long, clavate at the time of the anthesis, almost entirely exserted from the spathels; the calyx at first completely encloses the corolla, but later is deeply 3-lobed; the corolla is a little longer than the calyx and divided (not quite to the middle) into 3 oblong segments; the stamens have linear-oblong anthers; floral bracteoles are linear, hairy-paleaceous above, and give the spikes a tomentose appearance at certain periods of their development. *Female spadix* erect, with a stout axial part, divided into a few short, erect, thick spike-bearing branches; the lowest spathes are produced, from a short embracing base, into a very long (40 cm. in one speciment) acuminate solid point, which is armed with slender needle-like spines; the spathes of the branches are similar to those of the male spadix, but broader and shorter. *Female spikes* thickish (2 cm. in diameter) briefly stalked, 6—8 cm. long, spreading or recurved. Spathels coriaceous, united by their bases, but having a very broadly triangular concave, obtuse free part; they embrace 2 flowers, one of which is large and female, and

the other by its side, smaller and neuter, but nevertheless relatively large ; floral bracteoles short, very densely villoso-ciliate. *Female flowers* globose-ovoid, 8 mm. in diameter ; the calyx before the anthesis parted from a little below the middle into three lobes, later split entirely into three ovate, bluntish divisions ; the corolla a little longer than the calyx, divided to the middle into 3 triangular, thick, acute connivent segments, ventricose below ; staminodes apparently none ; ovary globose, distinctly 3-celled, covered densely with ascendent spiculiform scales ; style very short ; stigmas lanceolate-trigonous, acute connivent. *Neuter flowers* 9 mm. long, trigonous-pyramidate, acute and tapering below to a slender base. *Fruit* globose-turbinate, very variable in size and shape according to the number of seeds it contains, but always rounded at apex, and very shortly attenuate at base ; if the fruit contains only one seed it is globular and 4 cm. in diameter ; when the seeds are two it is subdidymous, and if there are three, the head is subtrigonous with rounded angles, and is 6–6·5 cm. in diameter. The pericarp is crustaceous and brittle, and is clothed with very numerous, a thousand or more, narrow thickish subulate-lanceolate, dark brown, glossy scales 8—10 mm. long, and 2–3 mm. broad at the base ; the scales of the upper part of the fruit are ascending, those of the middle are at first horizontal, or slightly deflexed with ascending points, those of the base are entirely deflexed. The remains of the stigmas form a small inconspicous mucro. The *seeds* are covered with a detachable integument 2 mm. thick and of a corky structure in the dry fruit ; when only one seed developes, it is globular and about 3 cm. in diam. ; when there are two, they are convex dorsally and have flat inner faces ; when three in number they are about 3 cm. long and broad, and 2·5 cm. thick, have also the dorsum convex, but show two flat inner faces, separated by a rounded salient angle, the side angles are also very obtuse ; in every case the surface is dark brown, even, but not polished, and shows a deep small apical hollow, leading to the canal containing the intrusion of the integument, which extends more than half way into the albumen. The albumen is bony and very hard ; the embryo is rarely basilar or in correspondence with the apical hollow, frequently it remains above the base and is sublateral, its position being indicated externally by a circular and slightly depressed area, 6 mm. in diameter.

Habitat.—Griffith established this species on male specimens only collected in the forests about Kujoo, in Upper Assam, in the Mishmee mountains, and in the lower ranges of hills on the borders of Upper Assam. My description is based entirely on very complete specimens forwarded to me by Mr. *G. Mann*, and collected in the Makum Forest in Upper Assam, with flowers in January 1888 and with mature fruits in October 1890.

Observations.—It is a very fine species, quite distinct from any other by its not very spinous leaves, having straight, lanceolate, acuminate leaflets all free, except the two at the apex, bristly spinulous on 3 costae on the upper surface, and marked by excessively minute and approximate tranverse veinlets ; by the male spadices being much branched with long spike-bearing, nodding or pendulous branches ; by the male spikes having a peduncular part about as long as their spathes ; by the female spadix being stout and erect, with several short

spike-bearing branches; by the fruit globose-turbinate 1–3-seeded, covered with innumerable, very narrow, subulate, lanceolate scales, partly ascendent, and partly recurved; by the large seeds, about as long as broad, globular or very obsoletely angular, and round on the back.

Griffith did not describe the leaves of this *Zalacca*, but most probably those that he attributes to *C. collinus* Griff. (= *C. erectus* Roxb.) belong to it as I have already pointed out in my monograph of *Calamus*.

Plate 54.—Zalacca secunda *Griff.*—An entire male spadix; the apex of a leaf. From Mann's specimens in Herb. Beccari.

Plate 55.—Zalacca secunda *Griff.*—Female spadix (in two parts) with very young fruits; fruits with 3 seeds, one in the upper, the other in the lower part of the plate; another fruit with two seeds; two seeds covered by the integument; two seeds divested of the integument; seed cut longitudinally through the intrusion of the integument and the embryo; seed in transverse section; intermediate leaflets. From Mann's specimens in Herb. Beccari.

9. Zalacca affinis Griff in Calc. Journ. Nat. Hist. v, 9; Palms Brit. Ind. 12, pl. CLXXVI, A. B. C.; Mart. Hist. Nat. Palm iii, 202, pl. ZXXI, f. IV; Becc. Malesia, iii, 67; Hook. f. Fl. Brit. Ind. vi, 169; Ridley, Mat. Fl. Mal. Penins. ii, 169.

Description.—Apparently does not differ much in habit from the other species. *Leaves* about 2·30 m. long in the pinniferous part; the petiole elongate, armed with very rigid, flattened, light-coloured, very acuminate, unequal, spreading or deflexed spines, 3—6 cm. long, 3—4 mm. broad at their bases, scattered or approximate in small series, some reduced to short sharp prickles; the rhachis is also armed below with fascicles of similar large spines in its lower portion, while above the spines become geminate or solitary and gradually smaller. *Leaflets* are all on one plane, but distinctly arranged in groups of 2—4 on each side of the rhachis with long vacant spaces interposed; are oblanceolate-spathulate, diminish below to a narrow, distinctly curved or sigmoid base, and are suddenly acuminate above to a slightly falcate point, which ends in a filiform setulose tip; they are green on both surfaces, slightly paler beneath, concave-convex or subinflated in their upper part, have 3 distinct costae, smooth on both surfaces, and several secondary nerves; transverse veinlets not very approximate; margins spinulous only near the apex; the intermediate leaflets are 35—40 cm. long, and 5—9 cm. wide in their upper third and broadest part; the lower leaflets are smaller, some of the apical ones are confluent. The *male spadix* is formed by several, elongate, flaccid, nodding tail-like spike-bearing branches, 45—50 or more (?) cm. long, having sessile spikes either solitary, or in groups of 2-3 at the axillas of the spathes; the latter are lanceolate acuminate, much longer than their respective spikes (10—18 cm. long), exsuccous, papyraceous, more or less split and lacerated, thinly and fugaciously rusty-furfuraceous. *Spikes* short, 3·5—6 cm. long, 12 mm. in diameter, when with fully developed flowers of a tomentose appearance, especially after the fall of the

flowers; the spathels or bracts of the spikes, although united by their bases do not form annular rings, but are distinct, bracteiform, membranous, broadly cordate, obtuse at apex and each embraces two flowers; the special flower bracteoles unite to form two shallow, membranous irregular cups, which are furnished with dense tufts of paleaceous hairs, attaining the level of the apex of the spathels. *Male flowers* narrow, 6 mm. long, clavate-oblong, and distinctly apiculate when in bud, immersed only with the calyx within the involucra; the calyx is at first urceolate 3-toothed and finally split more or less deeply into 3 oblong, striately veined divisions; the corolla is twice or nearly 3 times as long as the calyx, attenuate at the base, parted below the middle into 3 oblong, acute segments; the stamens have subulate filaments, and oblong anthers: the rudimentary ovary is very small and papilliform. *Female spadix* (or its divisions ?) 30—45 cm. long, composed of a central axis bearing several alternate, gradually decreasing sessile contracted, spiciform branchlets, which are embraced by a spathe longer than the branchlets themselves. The lower spiciform branchlets are 6-7 cm. long, and carry alternately (in the axillas of broad lacerate, accuminate secondary spathes) a depauperate sessile spikelet, composed of a very few (usually 3) flowers; the upper branchlets are gradually shorter, and have fewer groups of flowers; finally the uppermost of them has only one such group. Every female flower is embraced by a spathel, very broadly ovate, acute and usually slashed or laciniate; inside of every spathel are two special flower bracteoles (spathellules) rather large, imbricating by their bases, keeled, and hairy-paleaceous on their backs. Rudimentary or neutral flower not present. At times the uppermost flower of the groups is sterile. The *female flowers* are ovate, acute (in bud) 13—14 mm. long; the calyx is at first shortly 3-toothed, and almost completely encloses the corolla, later it is parted into 3 ovate, finely striately-veined, acute segments; the corolla, not much longer than the calyx, is entire, urceolate in its lower half and is parted above into 3 rigid, elongate-triangular, acuminate segments; the staminodes have rudimentary sagittate anthers; the ovary is ovoid, covered with flattened obtuse scales; the stigmas are sessile on the ovary, rigid, erect, trigonous-subulate, not attaining during the anthesis the apex of the corolla. *Fruit* ovoid, obovoid or ovoid-turbinate, somewhat tapering below, very obtusely trigonous, 5—6 cm. long., 3—4 cm. in diameter, conically mammillate at apex, terminated by the remains of the small connivent stigmas, which form a very small and acute mucro; scales in 24—26 longitudinal series, broadly rhomboidal, of a nearly uniform chestnut brown colour, being only slightly darker near the margins, neatly grooved along the centre, the grooves being continuous all along the entire length of the fruit, the margins obsoletely denticulate or nearly entire, and the apices slightly produced into an inconspicuous apiculum, which in the young fruits is rather prominent, rendering them scabrid to the touch. *Seeds* usually 3, enveloped in a fleshy integument, 2—3 mm. thick; when divested of this they are 2·5—3·5 cm. long, 18—20 mm. broad, oblong-subtrigonous, convex on the dorsum and with two inner faces separated by a faintly salient angle; the side angles are also obtuse; both ends are rounded; on the apex, is a deep small hollow, leading to a narrow channel, containing the intrusion of the integument, which extends somewhat less than half way into the albumen; the embryo is basilar, exactly opposite to the apical hollow and is

uncommonly large, about 12 mm. long, its position being indicated externally by a circular area 5 mm. in diameter; albumen homogeneous and hard.

HABITAT.—The Malay Peninsula and Sumatra. Near Malacca at Ching (*Griffith*) and at Batu Tiga (*Ridley* No. 1419). In the District of Perak at Larut (*King's Collector* No. 3448). Ridley l. c. gives also the following Malayan localities. Singapore: Bukit Timah, Chan Chu, Dindings: Gunong Tungul. In damp places in the forests at Kayu tanam Prov. of Padong in W. Sumatra (*Beccari*). It is also cultivated in the Botanic Garden of Buitenzorg as introduced from Lampong in the East of the Island. Native names: "Assam Cumbang" (King's collector); "Salak utan" (Ridley).

OBSERVATIONS.—This species with the two following form a distinct section in the genus *Zalacca*, on account of the female spadix not being composed of true flower spikes, but only of shortened branchlets, which bear in the axillas of secondary spathes small groups of 2—4 bracteate, solitary female flowers, not accompanied by neuter ones; further the fruits are smooth, being clothed with large flattened scales, of which the apices are not produced into an upturned subulate, or subspinous tip.

Z. affinis is characterized by its leaves having the petiole armed with large, rigid, scattered, or shortly seriate spines; by its leaflets being green on both surfaces, and in interrupted groups of 2—4 on each side of the rhachis, oblanceolate-sigmoid, suddenly acuminate to a setiform apex; by its male spadices having elongate branches, bearing short tomentose sessile spikes, solitary or in small groups in the axillas of much longer acuminate spathes; by its 3-seeded, ovoid or obovoid or subturbinate fruits with broad, appressed sharply grooved scales, disposed in 24—26 vertical series; by the seeds oblong, obtusely trigonous and enveloped in a sparingly fleshy integument.

I have described mainly the specimens collected by me in Sumatra, which however do not seem to differ essentially from those of Malacca, although a certain amount of variability may be observed in the size and width of the leaflets, and especially in the length of the female flower-bearing branchlets, and in the length of the male spikes. The size and shape of the fruit is also rather variable.

PLATE 56.—Zallacca affinis *Griff.*—Male spadix (or one of its divisions); intermediate portion of a leaf. From a specimen gathered by me in 1878 in the Garden of Buitenzorg from a cultivated plant introduced from Lampong in Sumatra (Herb. Beccari.)

PLATE 57.—Zalacca affinis *Griff.*—Intermediate portion of a leaf; female spadix (or a division of it?) with not fully developed flowers; one of the flower-bearing branchlets; branch of the spadix with mature fruits; three mature fruits, one entire, one cut open, showing two of the three seeds in situ, a third in transverse section; seeds cut longitudinally through the embryo and the apical pit. From these impcnes collected by me in Sumatra. The fruits were preserved in alcohol.

10. ZALACCA DUBIA Becc. Malesia, iii, 68.

DESCRIPTION.—*Leaves* exactly as those of *Z. affinis;* the petiole elongate, armed with very rigid, flattened, light coloured, very acuminate, unequal, spreading or deflexed spines, scattered or approximate in small series, 3—6 cm. long, 3—4 mm. broad at the base, some reduced to short prickles; the rhachis feebly armed below, in its lower portion, with a few spines similar to those of the petiole and smooth above. *Leaflets* all on one plane, in groups of 2—4 on each side of the rhachis with long vacant spaces interposed, oblanceolate-spathulate, tapering below to a narrow curved or sigmoid base, suddenly acuminate above into a slightly falcate point, and ending in a filiform setulose tip; they are green on both surfaces, slightly paler beneath, concavo-convex or subinflate in their upper part, have 3 distinct quite smooth costæ and several secondary nerves; transverse veinlets not very approximate; margins spinulous near the apex only; the intermediate leaflets are 60—70 cm. long, 8—9 cm. broad in their upper third and broadest part; the upper leaflets are shorter, and a few at the end are confluent. The *male spadix* (or one of its primary divisions?) forms a panicle about 40 cm. long, diminishing above, curved or nodding, composed of several short rather approximate spike-bearing branchlets, of which the lowermost are 12—15 cm. long and carry alternately 4—5 spikes; the upper branches become gradually smaller, and carry fewer spikes; the primary spathes are narrow, about as long as their respective branches, lacerated, finely rusty-furfuraceous; the *spikes* have a glabrous appearance, even after the flowers have fallen, are very shortly pedicellate or subsessile, solitary at the axilla of (and slightly longer than) their respective spathes, 3—4 cm. long, and when with full grown flowers are about 1 cm. in diameter; the spathels or bracts of the spikes, although united by their bases, do not form annular rings, and in correspondence to each pair of flowers are distinct, bracteiform, membranous, broadly cordate and obtuse at apex; the special flower bracteoles are so united together so as to form two truncate membranous cups not woolly, and provided only with some elongate subvesicular paleolae. *Male flowers* 5 mm. long, having only the base of the calyx immersed in the involucre, ascendent, oblong, obtusely trigonous, acute or apiculate, often slightly curved; calyx narrowing to an acute base and splitting into 3, oblong, striately-veined divisions; corolla usually twice as long as the calyx but at times less attenuate at the base, parted below the middle into 3 oblong acute lobes, stamens with subulate filaments and broadly linear or oblong anthers; rudimentary ovary very small and papilliform. *Female spadix* apparently very similar to that of *Z. affinis*, but smaller, and with shorter flower-bearing branchlets. *Fruit* elongate-ellipsoid or ventricose-fusiform and narrowly conical above, terminated by the connivent remains of the stigmas, which form a very small acute mucro; scales in 24 longitudinal series, rhomboidal, narrowly and not deeply grooved along the centre, chestnut-brown with a slightly darker intra-marginant line and with a blunt apiculum at apex, more produced and visible in the lower scales than elsewhere, and rendering the fruit scabrid to the touch; the margins nearly entire. *Seed* solitary (in the several fruits observed) ovoid-elliptical, terete, rounded at both ends, 2·5 cm. long, 13 mm. in diameter; the apical intrusion of the

integument extends one-third of the entire length of the albumen ; the embryo is basilar, exactly opposite to the apical hollow and also penetrates a third of the albumen ; the latter bony and homogeneous ; integument of the seed, scanty.

Habitat.—It is cultivated in the Botanic Garden at Buitenzorg, where I first in May 1870 collected some male specimens, from a plant introduced by Teijsmann, most probably from some of the Sunda Islands. Recently I have received (again from Buitenzorg) specimens of the same plant with male spadices and also, apparently, its fruits ; but in any case I think it safer to consider *Z. dubia* to be, as yet, established on the male plant only.

Observations.—It is certainly closely related to *Z. affinis*, from which it differs in the male spadices having several short spike-bearing branches, and by the spikes being shortly pedicelled, longer than their respective spathes and not tomentose; by the special bracteoles forming small cups, not woolly, but furnished only with a few elongate vesicular, piliform paleolae. The female spadix, supposed to belong to *Z. dubia*, is almost undistinguishable from that of *Z. affinis*, as is also the fruit, the latter however differing in containing one seed only and consequently in being much narrower, assuming that the presence of one seed only is a normal, not merely an occasional character.

Plate 58.—Zalacca dubia *Becc.*—Male spadix ; portion of the petiole ; intermediate portion of a leaf. Specimen from a plant cultivated at Buitenzorg in 1878 (Herb. Beccari).

Plate 59(A).—Zalacca dubia *Becc.*—Portion of a leaf near the apex ; branch of the fructiferous spadix ; mature fruits ; seed cut longitudinally through the apical pit and the embryo. All specimens from a plant cultivated at Buitenzorg (Herb. Beccari).

11. Zalacca borneensis Becc. Malesia, iii, 68.

Description.—Palm of which the fruit only is known ; certainly closely related to *Z. affinis* and *Z. dubia*. *Fruit* ovoid, suddenly attenuate above from a broad round base, terete, 5—5·5 cm. long, 3·5 cm. in diameter, having a conical mammillate point, terminated by a very small mucro formed by the remains of the stigmas ; scales in 18 longitudinal series, of a uniform chestnut-brown colour, broadly rhomboidal, considerably broader than long, the largest 1 cm. wide, sharply grooved along the centre, the grooves being continuous all along the entire length of the fruit ; the points of the scales are obtuse, and only in the lowest very slightly thickened or prominent. *Seeds* usually 3, enveloped by a not very thick fleshy integument ; when divested of this they are 2·5—3 cm. long, 15–20 mm. wide, 12—13 mm thick, oblong, subtrigonous, having a convex dorsum and two inner faces separated by a faintly salient obtuse angle ; the side angles are also obtuse ; both ends are rounded and above is a deep, small, apical hollow, leading to the intrusion of the integument, which penetrates ¼ of the entire length of the albumen ; the embryo is basilar, exactly opposite to the apical hollow, and also penetrates about the fourth part in length of the very hard homogeneous albumen.

Habitat.—Borneo; at Kuching in Sarawak (*Beccari*).

Observations.—The fruits of this species are very much like those of *Zalacca affinis*, of which *Z. borneensis* probably represents only a geographical form. The fruits of *Z. borneensis*, however, differ from those of *Z. affinis* in having the scales larger and disposed in 18 (and not in 24–26) vertical series.

Plate 59(B).—Zalacca borneensis *Becc.*—Three fruits at the bottom and on the right hand side of the plate, one cut open to show two of the three seeds in situ; a third seed cut longitudinally through the embryo and the apical pit. From specimens in alcohol (Herb. Beccari).

12. Zalacca conferta Griff. in Calc. Journ. Nat. Hist. v, 16: Palms Brit Ind. 19, pl. CLXXX, A.B.C.; Mart. Hist. Nat. Palm. iii, 201, p. 173, 174, Z. XIII, f. XXIX, and pl. Z. XXII, f. XIII; Becc. Malesia. iii, 67; Hook, f. Fl. Brit. Ind. vi, 473; Ridley, Mat. Fl. Mal. Penins, ii, 169.

Description.—A gregarious palm, dioecious? (or polygamous on different individuals—Griff.). Stem stout and very short. *Leaves* large, 5—6 m. long or more, including the petiole; the petiole alone about half the length of the pinniferous part, subterete, flattish above, of a soft structure internally, and consequently boldly wrinkled longitudinally in the herbarium specimens, armed with slender needle-like, light coloured or schistaceous spines, 4—5 cm. long and only 1—1·5 mm. broad at their bases, closely approximate in short transverse series; the rhachis is trigonous and armed throughout on its lower surface with the same kind of spines as the petiole. but more slender, and in smaller fascicles. *Leaflets* numerous, equidistant, alternate, green on both surfaces, very slightly paler beneath, very narrowly oblanceolate-ensiform, gradually attenuate below from above the middle to a straight (not sigmoid) base, and upwards to an acuminate. symmetrical or very slightly falcate apex; main nerves or costae 3, more or less bristly-spinulous on the upper surface towards the apex, where the margins are also spreadingly setose, otherwise smooth; transverse veinlets numerous, very sharp; the leaflets of the upper third part of the rhachis are 60—65 cm. long, 5 cm. wide; those above are gradually smaller, and all are individually distinct; only the two leaflets of the end, which are the smallest, are shortly united by their bases. *Male spadix* . . . . *Female* (or polygamous) *spadix* erect, composed of several, short approximate branches, each bearing 1—2 shortly stalked spikes, forming by their union a dense ovoid mass, 30—40 cm. long. Primary outer spathes papyraceous, sheathing in their basal part, unclosed and broadening above into a lanceolate. slightly spinous limb, prolonged into a very elongate, thickish. gradually acuminate point, which, occasionally, bears rudimentary leaflets at its apex; inner spathes smaller, membranous, very finely long-acuminate. *Spikes* erect, cylindrical, 12—14 cm. long, 2 cm. in diameter (when in flower), of a squarrose appearance since the spathels, at first connate and ring-like, soon separate and are kept gaping by the enlargement of the flowers; spathels rigid, very sharply striately veined, with the veins converging to a broad obsolete point. *Flowers* in pairs at each spathel, one of which, a female, has the appearance of

being a hermaphrodite, and the other of being neuter or else a male, both resting in a sort of bi-locular, rather deep, thinly membranous, veined cup, clothed on the angles with soft rufous wool. The *female flower* is ovoid, acute, 7—8 mm. long; the calyx almost entirely parted into 3 lanceolate, sub-coriaceous, acute parts; the corolla, one-third longer than the calyx, is parted nearly to the base into 3 ovate-triangular, acuminate, hard, coriaceous segments; staminodes 6, of which 3 are adnate to the centre of the segments and 3 alternate with the first three rise from nearly the base of the corolla, all with a subulate filament and a distinct (sterile) anther; ovary globose 3-celled; style very short and thick; stigmas elongate, thickly trigonous, subulate, spreading. *Neuter flowers* as long as the female, but narrower, trigonous, and acute; the calyx splits into 3 oblong divisions, subcartilaginous and strongly striately-veined; the corolla coriaceous and with a basal solid entire part, divided above into 3 ovate-lanceolate, thick segments; stamens 6 with thickish elongate filaments; anthers ovoid or oblong-sagittate. The *fruits* are crowded into an irregular, formless mass, sometimes of considerable size; the individual fruits are turbinate, more or less deformed by mutual pressure, slightly convex or flattish above, with a short small, mucro in the centre; when full grown 3·5—5 cm. long, 3—4·5 cm. in diameter in their uppermost part, and thence gradually tapering to a rather acute base; scales, in about 24 vertical series, shiny, of a dirty yellowish straw colour when dry, rhomboidal, slightly produced into a bluntish appressed point, more or less deeply grooved along the middle, especially in their posticous part; the margins finely erose-denticulate. *Seed* solitary, completely filling the pericarpal cavity, and attached to its base; its nucleus, is horizontally evolute in the middle of a copious fleshy integument, and is considerably broader than high, almost reniform in a vertical section, but somewhat varying in outline according to the deformation undergone by the entire fruit; when normally evolute the nucleus is discoid-suborbicular and depressed (in one specimen 22 mm. broad, and 10 mm. high); its surface, when divested of the integument, is chestnut-brown, quite smooth and shiny; it has the chalazal forea or apical intrusion of the integument (which is narrow and deep in all the species of the *Euzalacca* section) broad and shallow, orbicular, 9 mm. in diameter and 3 mm. deep; the integument is very abundant, pulpy, juicy, very acid and firmly adherent to the nucleus; the albumen is homogeneous; the embryo is placed exactly in the centre of the base. The cavity of the pericarp is lined by the very thinly membranous endocarp, which has a silky surface, and shows the obsolete markings of the external vascular ramifications of the seed integument. The pericarp is, on the average, 3 mm. thick.

HABITAT.—The Malay Peninsula, Borneo, Rhio and Bangka. *Griffith* writes that this palm flourishes in very shady wet places in the great forests of Malacca, as at Ching and Katawan. *Ridley* gives the following localities, viz., Singapore—Tanglin, Bukit Timah, Bukit Mandai, etc.; Selangor—Kwala Lumpur; Perak; Dindings; Lumut; Rhio. He adds that it is very common in wet woods forming impenetrable thickets in water. It occurs also in Bangka at Blinju, if I have correctly identified some sterile specimens collected there by *Grashoff* (No. 59 in Buitenzorg Herbarium). I have found this species in Borneo, at Kuching in Sarawak (P. B. No. 249.)

The pulp, or integument of the seed, which is intensely acid, is eaten by the Malays. It receives the names of "Asam Paya" and "Kelubi" (Ridley). Griffith says that it is the "Asam-Koomber" of Penang, and the "Asam-pajah" of the Malays of Malacca. The same sagacious author adds: "I have not yet ascertained what distinction is indicated by the two Malayan names bestowed on this species, from which it is probable, at least so experience tells me, that there are two distinct kinds, both presenting the same unusual sort of inflorescence, which is analogous to that of the genus *Elaeis.*"

The "Kelubi", by Griffith supposed a separate species, may be that described here below, or perhaps the male plant.

OBSERVATIONS.—It is a very distinct Palm, differing in some important characters from the typical *Zalaccas*, but especially in the fruit, which I have found constantly with only one seed, enveloped by a very copious integument, and having the nucleus discoid, horizontally evolute, and showing a broad and shallow apical chalazal fovea, instead of the usual narrow channel penetrating deeply into substance of the albumen. Further *Z. conferta* is characterized by its leaves regularly pinnate, having alternate, equidistant, straight, oblanceolate-ensiform, concolorous leaflets; by the female spadices erect, rigid, short and dense, bearing glabrous, subsquarrose spikes; by the densely aggregate turbinate fruits, having polished, deeply grooved scales with bluntish appressed tips.

Most probably *Z. conferta* is (in the same way as the true *Zalacca*) a dioecious Palm, and its male plant is unknown. Griffith writes: "That the spadices have polygamous spikes on different individuals", but apparently he, like myself, had opportunity to dissect only female spadices, which appear polygamous, but most probably their male flowers (although apparently normally evolute), have only sterile anthers. If the male spadix had not (as is the general rule in all *Zalaccas*) two equal male flowers at each spathel, this (added to its other special characters) would be another good argument for considering *Z. conferta* as the representative of a distinct genus.

PLATE 60.—Zalacca conferta *Griff.*—Female spadix (in two halves) bearing spikes with not fully developed flowers; detached spike with young fruits; portion of the head formed by the mature fruits; one fruit cut open vertically showing the solitary seed entire and in situ; vertical section of the fruit cut through the seed; half the pericarp, showing its cavity; seeds cut vertically into halves. From P. B. No. 249 in Herb. Beccari. The fruits from specimens in alcohol.

13. ZALACCA SCORTECHINII Becc. sp. n.

DESCRIPTION.—Apparently a smaller plant than *Z. conferta*. *Leaves* having a subterete petiolar part, 1·5 m. long, 1 cm. thick (in one specimen), armed with few, distant, scattered, solitary, rigid spines, 10—15 mm. long, apparently only some of the lowest being confluent; the rhachis, in its intermediate part, is bifaced above, rounded below, where it is armed along the centre with a line of small, distant, ascendent prickles. *Leaflets* numerous, equidistant, 5—7 cm. apart on each side of the rhachis, green and dull on both surfaces, distinctly sigmoid, equally

narrowing towards both ends, the base rather acute and considerably curved, the upper end falcately acuminate to a fine tip ; the main nerves or costae are 3, smooth, slender, but sharp on the upper surface ; there are 3 rather distinct secondary nerves on each side of the mid-costa ; transverse veinlets rather sharp, much interrupted, 2—3 mm. apart ; margins sparingly spinulous and only from the middle upwards ; the intermediate leaflets are 45 cm. long 3—3·5 cm. wide. The fruiting *spadix* is very much like that of *Z. conferta*, but smaller ; the spikes are smaller, 8—11 cm. long, 17 mm. in diameter. The *female* and *neuter flowers* are the same. The *fruit* is apparently smaller, and more regularly globose than in *Z. conferta*, 2—2·5 cm. in diameter ; the scales are very neatly grooved along the centre. The *seed* (not quite mature) is discoid. The pericarp seems thinner than in *Z. conferta*.

HABITAT.—Collected by Father *Scortechini* in the district of Perak in the Malay Peninsula ; the precise locality not stated.

OBSERVATIONS.—The description of this new species is derived from a portion of a spadix with nearly mature fruits accompanied by portions of a leaf ; the whole found among the Palms of Scortechini in a separate parcel, bearing as the only note : "Udang" which probably is the native name of the plant. I have little or no doubt that the fragments of a leaf accompanying the spadix do really belong to this plant, although the leaf differs considerably from that of *Z. conferta*, whereas the spadix is very similar. Z. *Scortechini* differs in many respects from *Z. conferta*, viz., in being a smaller plant, with leaves having the petiole armed with short, single, scattered spines, but more especially in having distinctly sigmoid leaflets and also in its smaller spadix, with smaller and rounder fruits.

PLATE 61.—Zalacca Scortechinii *Becc.*—An almost entire petiole, and intermediate portion of a leaf ; spadix with not quite mature fruits. From Scortechini's specimen in Herb. Beccari.

LATIN DIAGNOSIS.—Zalacca Scortechinii *Becc.* sp. nov. Minor ; frondium petiolo valde elongato, spinis paucis remotis sparsis raro confluentibus armato ; segmentis numerosis, aequidistantibus, utrinque viridibus, falcato-sigmoideis, 3-costulatis ; fructibus minoribus rotundatis.

PIGAFETTA Becc.

Becc. Malesia i, 89 (*Pigafettia*) ; Benth. and Hook. Gen. Pl. iii, 933—*Metroxylon* sect. *Pigafetta* Mart. Hist. Nat. Palm iii, 343.

A dioecious polycarpic large tree, with a very tall stem and an extensive crown of very large leaves ; the old leaves deciduous, leaving the trunk smooth after their fall. *Leaves* having a broad basal and embracing spinous part, a stout petiole (also spinous), and numerous subtricostulate straight, ensiform, acuminate, bifarious leaflets. *Male* and *female spadices* nearly similar, axillary, elongate, furnished with numerous but all incomplete spathes, and divided into several elongate tail-like branches, which are clothed with tubular, closely sheathing, approximate spathes and carry numerous slender spikelets. The *spikes*, both male and female, are amentiform and inserted at the bottom of their respective spathes by means of a very narrow elongate pedicellar part. *Male spikes* have very closely packed, geminate flowers, each pair of which is suffulted by a very small membranous bract, and is accompanied by tufts of hairs, representing the special flower bracteoles. *Male flowers* small and clavate ; the calyx campanulate, entire at first, then split into 3 parts ; the corolla has a narrow solid base and is divided into 3 valvate segments ; stamens 6, inserted at the throat of the corolla, the filaments short, the anthers basifixed ; no rudiment of an ovary. *Female spikes* covered all round with flowers, solitary at the axillas of the bracts and immersed in tufts of hairs. *Female flowers* globose ; the calyx cupular–urceolate, at first entire, later more or less split ; the corolla parted nearly to the base into 3 broad segments ; the stamens form with the united bases of their filaments a shallow cup, crowned by 6 teeth, bearing large sterile anthers ; ovary unilocular from the incompletely evolute dissepiments, globose, covered with a few large scales ; style very short ; stigmas trigonous, fleshy, spreading ; ovules 3, basilar. *Fruit* very small, monospermous, loricate with few relatively large scales. *Seed* covered by a fleshy integument ; albumen homogenous ; embryo opposite to a deep chalazal fovea.

The genus *Pigafetta* which Martius regarded as only a section of *Metroxylon*, is in reality a quite distinct genus, as is proved by its polycarpic nature, the plant producing a large number of axillary spadices, and having quite different male and female flowers and fruit.

In fact *Pigafetta* is not closely allied to any other known genus of *Lepidocaryeae* and is especially characterized by its arborous nature ; by its dioecious axillary spadices ; by its small male and female flowers, crowded on slender amentiform spikes and quite different in the two sexes (the male flowers being geminate, and the female solitary at each spathel) ; and by its small calamoid fruit.

Description of Plate VI.—B.

Figs. 1–8.—Pigafetta filaris *Becc.*—Fig. 1. Male flower during the anthesis.—Fig 2, vertical section of the expanded corolla.—Fig. 3–4. Full grown male–flower–buds.—Fig. 5. Female flower.—Fig. 6. Female flower, the corolla alone.—Fig. 7. Female flower, the nectarium and the ovary alone.—Fig. 8. Vertical section of the ovary. All figures enlarged about 10 diameters.

PIGAFETTA FILARIS Becc. Malesia, i, 89 (*Pigafettia.*).

Metroxylon filare Mart. Hist. Nat. Palm. iii, 216 and 343; Miq. Fl. Ind. Bat. iii, 149.

Sagus filaris Bl. Rumphia. ii, 154 and 128.

Metroxylon elatum Mart. l. c. 216.

Sagus elata Reinw. ex Mart. l. c.; Blume, Rumphia, ii, 156 t. 128, fig. 1.

Sagus microcarpa Zipp. in Bijdr. Nat. Wet. xv, 178. (ex Miq.)

Metroxylon microcarpum Mart. l. c. 216; Kunth. Enum. Plant iii, 215.

Sagus microsperma Zipp. l. c.

Metroxylon microspermum Mart. l. c.; Kunth, l. c.

Pigafettia papuana Becc. Malesia i, 89.

Sagus filaris Rumph, Herb. Amb i, 84, t. 19.

Calamus Kunzeanus Becc. in Ann. Roy. Bot. Gard. Calcutta, xi, 490, pl. 226 IV, f. 14–19 and Suppl. I, III and in Webbia iii, 244.

DESCRIPTION.—A very fine dioecious palm, up to 30 m. high. *Stem* solitary (non–soboliferous), straight, cylindrical, marked by the approximate scars of the fallen leaves; the wood very hard. *Leaves* very large, about 6 m. long, spreading, the old leaves reflexed and deciduous; leaf–sheaths short, embracing, furnished with narrow membranous, transverse, interrupted crests, bearing numerous pectinately set spinescent bristles; petiole very stout and also armed with comb-like series of spinescent bristles; the rhachis is broadly channelled on the upper surface of its lower portion, has an obtuse prominent angle above and is more or less furnished underneath and throughout with bristly spines. *Leaflets* very numerous, very regularly equidistant and very regularly bifarious in one plane, straight, broadly linear-ensiform, long-acuminate, attached to the rhachis by a rather broad base with reduplicate margins; they are rigidly papyraceous or thinly coriaceous, green on both surfaces, but slightly paler on lower, not very conspicuously 3- costulate, having the mid-costa very robust and prominent, slightly spinulous, but only towards the upper end, and only on the upper surface, obtuse and completely devoid of scales or spinules underneath; the side-costae slender, completely smooth, or in the leaves of young plants slightly spinulous; the intermediate leaflets of full grown plants 1·2–1·5 m. long, 5–6·5 cm. wide; those above become gradually smaller, more acuminate, and more distant, till the uppermost are only 30—40 cm. long; the lowest are narrower, more approximate, and distinctly callous at their axillas. *Spadices* axillary, several flowering at the same time, furnished with several incomplete, coriaceous, sheathing spathes, of which the outermost are shorter than the inner, flattened and truncated at their mouths, the innermost gradually extended beyond those below. *Male* and *female* spadices are similar as regards their branching, but appear different from the different aspect of the spikes; are considerably shorter than the leaves, 1·6—2 m. long, and form large, flaccid, dependent panicles, divided into several, elongate, tail-like partial inflorescences, or spike bearing branchlets; the latter are 60—70 cm. long, each furnished at the base with a coriaceous spathe, shaped like an ass's ear, tubular in its lower

portion, but unclosing and spreading open above into a triangular acute limb fugaciously clothed with a fulvous scurf; the axial part of the branchlets is terete, about 1 cm. in diameter at the base, gradually diminishing above; its spathes are papyraceous, glabrous, smooth, finely striately-veined, tubular, closely sheathing, obliquely and lunately excavate at the mouth, and there prolonged at one side into a triangular-ciliolate point; the lowest is 3·5–4 cm. long; the others gradually smaller. *Male* and *female spikes* attached by a very slender, strongly flattened pedicellar part to the bottom of their respective spathes and more or less produced beyond these. *Male spikes* slender, flexuose, the lowest borne on a pedicellar part 6–7 cm. long (shorter in those which follow), not broader than 1·5 mm., flattened-laminar, strongly-striate; the flower bearing portion of the spikes is 8–9 mm. in diameter (when covered with fully developed flowers), 10–12 cm. long, in the spikes of the lower part of the branches, but only 7–8 in those of the apex. The axis of the spikes is slender, and after the fall of the flowers acquires a villose appearance from the persistent spathels, which are represented by small membranous striately-veined bracteoles having a broad base, which suddenly attenuate to a subulate, spreading point, and are accompanied at each side by brush-like tufts of hairs, which replace the special bracteoles of the flowers. The *male flowers* are very closely packed, in pairs at each spathel, and completely cover the axis of the spikes, on which their insertion is marked by two very small, elongate, contiguous scars. The flower-buds not regularly ovoid, are obsoletely trigonous, 3—3·5 mm. long; the calyx is thinly membranous, cupular-campanulate, strongly-striately-veined, and with 3, often unequal, short or obtuse teeth; at the time of the anthesis the flowers lengthen out to 4 or 4·5 mm., the calyx becomes almost inflate, and usually splits open irregularly; the corolla is twice as long as the calyx; the portion covered by the calyx is narrow and solid and is parted above into three cartilaginous ovate-cymbiform, acute, externally finely striate segments. Stamens 6, inserted at the throat of the corolla; the filaments short, triangular and shortly united by their bases; anthers basifixed, ovate-sagittate, rather acute, the cells opening laterally: rudimentary ovary obsolete. *Female spikes* thicker than the male ones, and similarly provided with a very slender pedicellar part; the flower-bearing part is 7—10 cm. long, terete, of a tomentose appearance, 4 mm. in diameter, not including the flowers. The axis of the spikes is slender and woody, and the spathels, which are inserted all round it, are very small, bracteiform, subulate, very similar to those of the male spikes, and completely concealed by a pale yellowish tomentum, their tips (only) protruding above it; the flowers themselves are almost buried in a nestlike cup, formed of radiating hairs. *Female flowers* solitary (*i.e.*, unaccompanied by a neuter), small, globose, 2·5 mm. in diameter at the time of the anthesis; the calyx cupular-urceolate, its mouth truncate, thinly membranous, strongly-veined-costulate; the corolla deeply parted into 3 thickly membranous striately veined segments, broadly ovate, their triangular points only protruding beyond the calyx. The androecium is well developed, having large erect sagittate-acuminate anthers nearly as long as the segments of the corolla but sterile and membranous-hyaline; the filaments by their broadened, connate bases, form a shallow cup, crowned with 6 short triangular teeth; ovary globose, covered with a few relatively large fimbriate

scales, unilocular from the incomplete development of the dissepiments; style very short; stigmas thick, elongate-trigonous, spreading; ovules 3, basilar, erect. *Fruit* small, when thoroughly mature only slightly longer than broad, 10–12 mm. in diameter; before perfect maturity of course smaller and very broadly ovoid or subobovoid; it is always rounded at both ends, but especially at the apex, where it is not mucronate; scales in 12–13 longitudinal series, very few in each series (5–6 only well formed), shiny, straw-coloured, relatively large, rather convex, channelled along the middle with a narrow dark-brown or blackish marginal line, their apices very obtuse, the margins finely erosely-toothed. The pericarp is very thin and fragile. *Seed* ellipsoid, somewhat flattened, 7–8 mm. long, 5–6 mm. broad and 3·5–4 mm. thick; its surface unequal from small depressions and straight ridges (when it is cleared of the crustaceous and brittle but once fleshy integument), which radiate especially from the chalazal fovea; the latter deep, circular, placed in the centre of the raphal side; albumen equable; embryo in the centre of the face opposite to the chalazal fovea. *Fruiting perianth* not accrescent, explanate, 5 mm. in diameter; calyx splitting down to the base into 3 very broad, almost orbicular, very broadly-striately veined lobes; the segments of the corolla as long as the calyx, ovate, and also striately veined. It is one of the tallest of Palms.

Habitat.—Celebes; the Moluccas; New Guinea; Indo-China. It seems a Palm more frequent in Celebes than elsewhere. From North Celebes I have seen specimens collected by *Warburg* at Bojon; by the *Brothers Sarasin* at Tomohon in the Prov. of Minahassa (No. 801 in Berlin Herb.) and *Koorders* (No. 18427B in Herb. Bogor.). According to Rumph it grows also in Ceram and Buru. In N.-W. New Guinea, *Pigafetta* is apparently a rather common plant. I collected specimens of the male plant (*P. papuana* Becc.) at Andai at the foot of Mt. Arfak, and *Teijsmann* gathered the fruits in Pulo Roon (Herb. Bogor.) and *Miss. L. S. Gibbs* at Manokoari.

Its presence in Indo-China rests on some loose fruits collected by O. Kunze in Cambodia.

The rather wide geographical distribution of this Palm is probably due to its small innumerable fruits, provided with a rather scanty but fleshy pulp, which are almost certainly used by birds for food, especially wild pigeons which are some of the most effective agents of dissemination in the Papuan and Malayan Islands.

Observations.—I have based the description above mainly on specimens gathered from plants cultivated in the Botanical Garden at Buitenzorg, but the fruits of the wild plants from Celebes and New Guinea are quite identical with those of the cultivated.

I think there is only one species of *Pigafetta*, as the specifical differences between *Metroxylon filare* and *M. elatum* indicated by Blume, Martius and Miquel seem to me very obscure, and I have not noticed any diagnostic character among the numerous specimens of *Pigafetta* examined by me. The size and form of its

fruits are very variable features depending upon the degree of maturation ; this is because the fleshy integument of the seed, which, as often happens in similar fruits of *Lepidocaryeae*, increases in volume in the last stage of maturity and dilates the scaly pericarp.

The calyx of the male flowers is always entire in the flowers before they open, but split into 3 parts afterwards, and offers no characters whereby *P. elata* can be distinguished from *P. filaris.* In the plate of *Sagus filaris*, Rumphia 128, the corpuscules which are shown on the midcosta on the lower surface of the leaflets, look like spinules, but I have never seen spinules or scales or paleoles on the lower surface of the leaflets in any of the numerous specimens of *Pigafetta* seen by me, whether considered as *P. filaris* or as *P. elata.* Miquel also describes (Fl. Ind. Bat. iii, 149), but I think erroneously, the mid-costa of the leaflets "subtus paleolis inspersa." On the upper surface the mid-costa of the leaflets is frequently spinulous towards the upper end, and in leaves of young plants the side costæ are spinulous also.

I now regard *P. papuana* as quite identical with *P. filaris.*

The figure in Martius iii, t. 102, said to represent the whole plant of *Sagus elata*, is another Palm, apparently an *Arecinea.* A good representation of *Pigafetta* has been given in the book of P. and Fr. Sarasin (Reisen in Celebes 1, p. 54).

Plate 62.—Pigafetta filaris *Becc.*—The end of a leaf ; one of the branches of the male spadix ; the base of the petiole ; a very young spadix. From plants cultivated at Buitenzorg (Herb. Beccari).

Plate 63.—Pigafetta filaris *Becc.*—Branch of the female spadix in flower ; fruiting branch ; intermediate leaflets from a young and very robust plant. From plants cultivated at Buitenzorg (Herb. Beccari). Spike with thoroughly mature fruits and seed, from Bojong in Celebes.

Plate 63A.—Pigafetta filaris *Becc.* in the Botanic Garden at Buitenzorg.

KORTHALSIA Bl.

Bl. Rumphia ii, 166, t. 130, f. 2 (*Ceratolobus* Blume ibid, iii, t. 197–157 B); Mart. Hist. Nat. Palm. iii, 210, 343, t. 172, f. 1; Miq. Fl. Ind. Bat. iii, 74, 750 and Prodr. Fl. Sum. 591 and De Palm. Arc. Ind. 15–26; Walp. Ann. iii, 492; Becc. Malesia, ii, 62, t. V, VI, VII and 275; Benth. etd. Hook. Gen. Pl. iii, 932; Hook. f. Fl. Brit. Ind. vi, 474; Ridley, Mat. Fl. Mal. Penins. ii, 214; Kurz in Journ. Asiat. Soc. Beng. xviii, II (1874), 206 t. XX A and XXI; Forest Fl. Brit. Burma, ii, 512. *Calamosagus* Griff. in Calc. Journ. Nat. Hist. v, 6 and Palms Brit. Ind. 26, t. 175 and 180 c; App. XIX.

Climbing, calamoid, monocarpic, hermaphrodite, spinose palms, bearing a terminal branched diffuse panicle. *Leaves* of the lower part of the stem or of young plants non-cirriferous, terminated by a leaflet; those of the adult plant cirriferous. *Leaf–sheaths* elongate, more or less spinous, not flagelliferous, not gibbous above and gradually passing into the petiole, prolonged beyond the insertion of the petiole into a distinct ocrea, frequently inflate, and ant–harbouring. *Leaflets* mostly rhomboidal, trapezoidal or cuneate with several radiate nerves, more rarely narrow and elongate, but always pluricostulate and more or less toothed or praemorse at the upper end, and attached to the rhachis through a small pedicellar part (ansa). *Panicle* composed of several spike-bearing branches, issuing from the sheath of more or less reduced leaves; the branches are sheathed by several tubular spathes. *Spikes* amentiform, formed by very approximate membranous spathels, each shielding only one hermaphrodite flower, which is provided with bracteoles more or less woolly or covered with paleaceous hairs. *Flowers* small; the calyx campanulate-cyathiform or cupular, more or less 3-lobed; the corolla longer than the calyx, parted in the portion remaining outside the calyx into 3 cartilaginous or thinly coriaceous segments, entire and tubular or ventricose in its lower part; stamens with filaments adnate to the undivided part of the corolla, forming a small ring at its throat, and having a short, thick, free part; anthers short, erect, inserted near the base, and having parallel cells, opening on the sides. Ovary incompletely 3-locular or with rudimentary dissepiments, ovoid, prolonged into a thick, elongate-conical style, and terminated by 3 very minute, acute, punctiform stigmas. Ovules 3, basilar, erect, anatropous. *Fruit* monospermous, the pericarp covered with imbricating scales. *Seed* erect, enveloped with a scanty fleshy or spongy integument; the nucleus not pitted on the surface, but marked by a conspicuous lateral chalazal fovea, or a deep intrusion of the integument; albumen homogeneous or ruminate; embryo lateral.

A very natural genus, easily recognizable, even in a sterile condition, by the special nature of its leaves, having, indeed, leaflets of various shapes, but always with several main nerves and with a more or less toothed or praemorse extremity and furnished with a small pedicellar part or "ansa". A peculiar character of *Korthalsia* is also the great development of the appendage at the mouth of the leaf-sheaths (the ocrea) which at times is transformed into a swollen and entirely closed ant-harbouring organ or nidus, of a constant form for every species

(*K. scaphigera, scaphigeroides, Echinometra, horrida, Cheb, angustifolia, Scortechinii, furcata*). Regarding the biology of *Korthalsia* I refer the reader to my article on the "Piante ospitatrici" (Malesia, ii, p. 62). In *K. robusta* and *K. macrocarpa*, the ocreae do not form an entirely closed dwelling for ants but take the shape of large cornets embracing the base of the sheaths immediately above them, and at times attaining the extraordinary length of 30 to 40 cm. In most species, however, the ocreae are cylindrical, closely sheathing, and often partially disintegrated into a fibrous net. The form and peculiarities of the ocrea afford often the best characters by which to distinguish the species, even if flowers and fruit be wanting. The nature, origin, and function of the ant-harbouring organs, not only in *Korthalsia*, but in numerous other myrmecophilous plants, and most of all, in *Myrmecodia* and *Hydnophythum* have been much discussed. With regard to this subject I retain my old opinion that, such organs are now hereditary, but that they owed their origin to the effects of the stimulus exerted by ants on certain organs of the plants, of which the tissues were capable of a reactive power during the remote period of the plasmation Epoch, when heredity had not yet acquired its actual conservative power. (See Beccari "Wanderings in the Great Forests of Borneo," pp. 36, 209 and seq.). The *Korthalsias* have been, for a long time, only very imperfectly known, and it was generally believed that they were bisexual plants. In reality they have only one kind of amentiform or catkin-like spikes, which at times closely resemble those of *Metroxylon*, but which differ from them in having only one hermaphrodite flower in the axillas of very closely packed spathels.

Although I had for several years made every effort to obtain the flowers and fruits of the several species of *Korthalsia*, there are even now at least 8–9 species which are represented in Herbaria only by sterile specimens. This is explained by the circumstance that the stems or Rotangs of *Korthalsias* are very eagerly searched for and much valued by the natives, but on account of their monocarpic nature are very seldom to be met with in the accessible parts of the forest, either in flower or in fruit, for the stems are almost always cut down before they can produce the inflorescence. The species of *Calamus* are more easily found in a fertile condition, as they are polycarpic plants, beginning to bear early.

The Rotangs or naked canes of *Korthalsias* being very tough, are very much used by the natives for tying and other uses, but have not much value as a commercial product, not having a fine and polished surface.

The *Korthalsias* are apparently soboliferous plants, and have like other calamoid palms, stems very slender in the early period of their life, but gradually thickening with age, their greatest diameter being attained at their upper end, at the time of flowering.

In connexion with the Myrmecophilism of *Korthalsias*, it has to be remarked that apparently certain species are furnished with extranuptial nectaries in the axillas of the leaflets, in the shape of conspicuous callosities or cushions; analogous

organs are also frequently found, but on a smaller scale, at the base of the ansae of the leaflets.

As in *Calamus* some species of *Korthalsia* have a seed with homogeneous albumen (*K. gracilis*, *K. Zippelii*, *K. macrocarpa*), but more frequently the seed has a ruminate albumen (*K. scaphigera*, *K. laciniosa*, *K. ferox*, *K. Teijsmannii*, *K. Junghuhnii*).

The leaves of *Korthalsia* vary greatly according to the age of the plant. The primordial leaves are entire, oblong or spathulate (*K. rigida* and *K. flagellaris*), or simply forked (*K. scaphigera*); those of plants that are just forming a stem are always terminated by a leaflet, simple or bipartite; only the leaves of the upper part of the adult plants are constantly cirriferous. I know of only one species (*K. furcata*) that appears to retain the primitive form of leaves into the adult stage, and has therefore non-cirriferous leaves only; but of that species the flowering plant is not known, and possibly the leaves of the upper part of the plant, nearing the stage of flowering, also follow the rule and become cirriferous.

Geographical distribution.—*Korthalsia* is pre-eminently a Malayan genus, having its centre, as regards number of species, in Borneo, the Malay Peninsula, and in Sumatra; it has however a few representatives in Java, in the smaller Sunda Islands, in the Andamans and in the Nicobars, in Indo-China, in the Philippines, in Celebes and in New Guinea. Borneo is the region richest in *Korthalsia*, 12 species, of which 8 are endemic having been discovered there; then comes the Malay Peninsula with 8 species, 3 of which are endemic, and Sumatra with 7 species, of which only *K. robusta* is not known as growing elsewhere, although closely related to the Bornean *K. macrocarpa.*

At least 3 species grow in the Philippines,—*K. scaphigeroides*, *K. squarrosa*, and *K. Merrillii*, all evidently derived from Malayan species; in fact *K. scaphigeroides* only slightly differs from *K. scaphigera*; *K. squarrosa* is evidently related to *K. robusta* of Sumatra, and even more closely to *K. macrocarpa*, a palm growing in the marshy grounds of the littoral regions of South Borneo. *K. Merrillii* appears to be related to a *Korthalsia* recently discovered (sterile) in Celebes, itself seemingly an ally of the Bornean *K. ferox.*

K. laciniosa is perhaps the most widely dispersed species, attaining at the same time the most northerly latitude, having been found near Salween in Tenasserim; otherwise the genus is entirely absent from the true Indian Flora. *K. laciniosa* is also a common plant in the Andamans and Nicobars and in the Mergui Archipelago, and probably it extends into lower Indo-China; it is apparently a sea-coast palm, a circumstance to which we may attribute, perhaps, its relatively wide geographical distribution, and the presence of its very closely allied species *K. ferox* and *K. Teysmannii* in the neighbouring countries.

Korthalsia Zippelii, widely spread all over New Guinea, and growing also in the Aru Islands, is the only representative of the genus *Korthalsia* found, as yet, to the eastward of Celebes.

Korthalsia.	Tenasserim.	Mergui Archip.	Andamans.	Nicobars.	Malay Peninsula.	Singapore.	Sumatra.	Bangka.	Billiton.	Java.	Borneo.	Indo-China.	Celebes.	Philippines.	New-Guinea.	Aru-Islands.
1. K. scaphigera *Mart.* ...	...	...	...	...	+	+	+	...	...	...	+	...	...	...	...	...
2. K. scaphigeroides *Becc.* ...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...
3. K. Echinometra *Becc.* ...	...	...	...	...	+	...	+	+	...	...	+	...	...	...	...	...
4. K. horrida *Becc.* ...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...
5. K. Cheb *Becc.* ...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...
6. K. Scortechinii *Becc.* ...	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...
7. K. angustifolia *Bl.* ...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...
8. K. furcata *Becc.* ...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...
9. K. paucijuga *Becc.* ...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...
10. K. debilis *Bl.* ...	...	...	...	...	...	...	+	...	...	...	+	...	...	...	...	...
11. K. rigida *Bl.*	...	...	...	...	+	...	+	+	+	...	...	...	...	...	...	...
12. K. Junghuhnii *Miq.* ...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...	...
13. K. Merrillii *Becc.*	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...
14. K. celebica *Becc.*	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...	...
15. K. Rogersii *Becc.*	...	...	+	...	...	...	...	...	...	...	...	...	...	...	...	...
16. K. tenuissima *Becc.* ...	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...
17. K. laciniosa *Mart.* ...	+	+	+	+	—	...	+	...	...	...	...	+	...	...	...	...
18. K. Teysmannii *Miq.* ...	...	...	...	...	...	+	+	...	...	+	...	...	...	...	...	...
19. K. ferox *Becc.*	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...
——— VAR. malayana *Becc.*	...	...	...	...	+	...	...	...	...	...	...	...	...	...	...	...
20. K. Wallichiæfolia *Wendl.*	...	...	...	...	+	+	+	...	...	...	...	...	...	...	...	...
21. K. Hallieriana *Becc.* ...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...
22. K. flagellaris *Miq.* ...	...	...	...	...	+	...	+	...	+	...	+	...	...	...	...	...
23. K. Zippelii *Bl.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...
——— VAR. aruensis *Becc.*	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	+
24. K. robusta *Bl.*	...	...	...	...	...	...	+	...	...	...	...	...	...	...	...	...
25. K. macrocarpa *Becc.* ...	...	...	...	...	...	...	...	...	...	...	+	...	...	...	...	...
26. K. squarrosa *Becc.* ...	...	...	...	...	...	...	...	...	...	...	...	...	...	+	...	...

KORTHALSIA.

KEY TO THE SPECIES.

A.—Spikes amentiforn having very closely packed and appressed spathels.

I.—*Ocrea inflated.*

* Leaves pinnate with several leaflets.

† Leaflets cuneately rhomboidal. Ocrea small, armed with very short spines.

Ocrea oblong or ovate, not more than twice as long as broad. Leaflets whitish underneath or only paler below than above.

I. K. scaphigera Mart.—Malay Peninsula, Singapore, Sumatra, Borneo.

Ocrea elongate—elliptical, two or three times longer than broad. Leaflets conspicuously mealy-white underneath.

2. K. scaphigeroides Becc.—Philippines.

†† Leaflets elongate narrowing at apex. Ocrea large, elliptical, armed with very long spines.

Leaflets linear—lanceolate having smooth, or sparingly spinous nerves.

3. K. Echinometra Becc.—Malay Peninsula, Sumatra, Bangka, Borneo.

Leaflets elongate—ensiform, copiously spinulous on the main nerves.

4. K. horrida Becc.—Borneo.

††† Leaflets elongate—cuneate or cuneately rhomboidal. Ocrea very large, several times longer than broad, armed with short spines.

Ocrea cylindraceous, thickly coriaceous, very long; leaflets elongately cuneate-rhomboidal.

5. K. Cheb Becc.—Borneo.

Ocrea fusiform, thinly coriaceous, leaflets narrow, very long cuneate.

6. K. Scortechinii Becc.—Malay Peninsula.

Ocrea fusiform, rather thinly coriaceous; leaflets cuneately oblanceolate or cuneate-rhomboidal, acuminate.

7. K. angustifolia Bl.—Borneo.

** Leaves furcate or formed by only two linear segments.

8. K. furcata Becc.—Borneo.

II.—*Ocrea not inflated.*

* Leaves (of the adult plant) having only 3 leaflets on each side of the cirriferous rhachis.

Petiole very short; leaflets cuneately oblong, besprinkled on the lower surface with minute ferruginous dots.

9. K. paucijuga Becc.—Borneo.

** Leaves having 4 or more rhomboidal leaflets on each side of the rhachis.

† Slender plants (sheathed stem 4–18 mm. in diam.).

§ Leaflets whitish beneath ; spikes of slightly tomentose appearance.
Flowers almost entirely exserted from their involucra. Seed with homogeneous albumen.

10. K. debiis Bl.—Sumatra, Borneo.

§§ Leaflets slightly paler beneath than above ; spikes slender of a glabrous appearance ; the spathels are produced somewhat beyond the wool of the flower bracts.

Leaflets at first subglaucous beneath, later almost equally green on both surfaces. Fruit very small.

11. K. rigida Bl.—Malay Peninsula, Sumatra, Bangka, Billiton.

Leaflets at first whitish beneath, later only slightly paler than above. Fruit globose-turbinate, 14-15 mm. in diam. Seed with albumen ruminate.

12. K. Junghuhnii Miq.—Java.

§§§ Leaflets green or nearly so on both surfaces. Spikes of tomentose appearance (not known in *K. celebica*).

Ocrea very densely spinous. Leaflets having the upper margins very acutely toothed ; the two lowest leaflets of each leaf much smaller than the mesial.

13. K. Merrillii Becc.—Philippines.

Ocrea unarmed. Leaflets having the upper margin very obtusely toothed ; the two lower leaflets of every leaf about as large as the mesial.

14. K. celebica Becc.—Celebes.

Ocrea unarmed. Leaflets having the upper margin very acutely toothed ; the two lower leaflets of every leaf smaller than the mesial. Fruit globose, relatively large, 15 mm. broad, with scales having the tip appressed and the margins ciliate, very slender.

15. K. Rogersii Becc.—Andamans.

§§§§ Leaflets chalky white underneath.

Sheathed stem 4—5 mm. in diam. Ocrea smooth. Inflorescence formed of only 2—3 spikes.

16. K. tenuissima Becc.—Malay Peninsula

†† Large with robust stem (sheathed stem over 2 cm. in diam.).

§ Spikes thickish of tomentose appearance, the spathels being almost entirely immersed in the wool of the flower bracts.

⊙ Spadices simply branched.

▲ Leaflets broad, rhomboidal, having the upper margins double toothed, the teeth aristate or at least acute. Seed with ruminate albumen.

Fruit obovoid, suddenly long-beaked, 11 mm. broad, having subsquarrose scales with fringed margins and the tip not produced.

17. K. laciniosa Mart.—Tenasserim, Mergui, Andamans, Nicobars.

Fruit obovate-turbinate, 17-18 mm. in diam., having subsquarrose scales with produced conspicuously ciliately fringed tips.

18. K. Teysmannii Miq.—Singapore, Sumatra, Java.

Fruit oblong-clavate, having scales with minutely ciliately fringed margins and obtuse appressed tips. Ocrea unusually armed with large spines.

19. K. ferox Becc.—Borneo.

A smaller plant. Fruit unknown.

K. ferox VAR. **malayana** Becc.—Malay Peninsula.

▲▲ Leaflets broadly rhomboidal, obtusely toothed (Fruit unknown).

Leaflets, numerous, alternate.

20. K. Wallichiaefolia Wendl.—Malay Peninsula, Singapore, Sumatra.

Leaflets very few opposite, or nearly so.

21. K. Hallieriana Becc.—Borneo.

▲▲▲ Leaflets linear-cuneate or cuneate, ferruginous underneath, having the upper margin nearly truncate, deeply and sharply toothed. Ocrea very long (20–30 cm.).

22. K. flagellaris Miq.—Malay Peninsula Sumatra, Billiton, Borneo.

⊙⊙ Spadix having the primary branches sub-divided into smaller spike-bearing branchlets. Seed with homogeneous albumen. Leaflets large, elongate-rhomboidal, having the upper margin acutely toothed.

Panicles elongate.

23. K. Zippelii Bl.—New-Guinea.

Panicles ovate.

K. Zippelii VAR. **aruensis** Becc.—Aru Islands.

B. Spikes relatively large, of squarrose appearance, the spathels being scarious and not very appressed. Flowers relatively large. Seed having a deep intrusion of the integument and a homogeneous albumen.

Ocrea cornet-shaped, very elongate, narrowing above. Flowers with the style reaching only to the throat of the corolla.

24. K. robusta Bl.—Sumatra.

Ocrea cornet-shaped, narrowing above, very long (20–40 cm.). Leaflets having a very long and slender ansa. Flowers with the style surpassing the throat of the corolla and reaching to about midway of the anthers.

25. K. macrocarpa Becc.—Borneo.

C. Ocrea truncate, about 12 cm. long. Leaflets having a rather short ansa (5–12 mm. long). Flowers with the style surpassing the throat of the corolla, and reaching to about midway of the anthers.

26. K. squarrosa Becc.—Philippines.

DESCRIPTION OF PLATE IV.

FIGS. 1—6. Korthalsia macrocarpa *Becc.*—Fig. 1. Flower having the spathel behind and accompanied with its woolly bracteoles.—Fig. 2. Flower stripped of one of the division of the corolla and of two stamens, showing the pistil with the stigmas protruding above the throat of the corolla.—Fig. 3. Vertical section of a flower showing the ovary entire.—Fig. 4. Vertical section of the ovary (All the preceding figures enlarged 7 diameters).—Fig. 5–6. Vertical and horizontal sections of the seed, twice enlarged.

FIG. 7—8. Korthalsia robusta *Bl.*—Fig. 7. Flower entire.—Fig. 8. The same flower in vertical section showing the pistil entire with the stigmas attaining only the throat of the corolla (enlarged 7 diameters).

FIG. 9—15. Korthalsia scaphigera *Mart.*—Fig. 9. Full grown flower bud with its falcate woolly bracteoles and the spathel behind.—Fig. 10. The same flower with its spathel.—Fig. 11. Entire full grown flower bud.—Fig. 12. Flower bud stripped of two divisions of the corolla, and showing the androecium entire.—Fig. 13. Vertical section of a flower bud showing the ovary entire and *in situ* (all the preceding figures enlarged 7 diameters).—Fig. 14–15. Vertical and horizontal sections of the seed (X2).—Fig. 16. Diagram of a spathel with its flower and bracteoles.

DESCRIPTIONS OF SPECIES.

1. KORTHALSIA SCAPHIGERA Mart. Hist. Nat. Palm. iii, 211 and 373, t. Z. VIII, f. II, III; Miquel Fl. Ind. Bat. iii, 750 and De Palm. Arc. Ind. 26; Hassk. Cat. Hort. Bogor. 1866. 73; Becc. Malesia. ii. 67. t. 5; Hook. f. Fl. Brit. Ind. vi, 475; Ridley Mat. Fl. Mal. Penins. ii. 216.

K. Lobbiana H. Wendl. in Bot. Zeit. xvii, 174; Miq. ll. cc.

Calamosagus scaphiger Griff. Palms Brit. Ind. t. CLXXXIV-A.

C. Wallichiaefolius Griff. ex. Mart. l. c. 211, non-Griff. in Calc. Journ. Nat. Hist. v, 25 (*vide* Becc. Malesia l. c. p. 68).

DESCRIPTION.—High scandent and slender. *Sheathed* stem usually 10–12 occasionally 5–7, or at most 17 mm. in diameter. *Leaf-sheaths* armed with scattered, short, conical, horizontal prickles. *Ocrea* inflated, cymbiform-elliptical, oblong or ovate, closely and almost entirely embracing the base of the next sheath and often distinctly pedicellate; in the intermediate leaves the ocrea is 2·5–5·5 cm. long and 12–25 mm. broad; in the leaves nearer the inflorescence it is shorter and less embracing; it is thinly coriaceous and armed similarly to the sheath with short conical prickles. *Leaves* of the lower part of the stem non-cirriferous, 30–45 cm. long in the pinniferous part, ending in a cuneate-flabelliform leaflet, and having the petiole slender and elongate; the intermediate leaves are cirriferous, 40–50 cm. long in the pinniferous part and end in a very slender and clawed flagellum about as long, or somewhat longer; the petiole is very variable in length. from 3 to 12 cm. long, flattened, biconvex with sharp, more or less prickly edges and backs; the rhachis is armed irregularly with scattered or 2–3-nate claws. *Leaflets* not numerous, usually 4, more rarely 5–6, on each side of the rhachis, subopposite or alternate, elongately cuneate towards an acute base, generally inequilateral in their upper part, with the anterior margins praemorse and more or less produced to a caudate apex, rigid, green above, paler or (especially when young) whitish beneath; they have usually 7 primary nerves, and very numerous, fine, transverse veinlets; in intermediate leaves the leaflets are 12—23 cm. long, and 4—7 cm. wide at the beginning of the toothed margins, rarely more; the lower leaflets are usually smaller and narrower than the upper. The leaves of the upper part of the plant, especially those nearer to the inflorescence, are smaller than the preceding, and have smaller and more distinctly ansate leaflets, the ansae being very strongly flattened, and sometimes up to 8—10 mm. long; in the intermediate leaves the ansae of the leaflets are often very short, and in their axillas a small callosity or cushion, having a transverse furrow, is to be found. The young plants, about to form a stem, are caespitose with several leaves, which have a very long petiole and a deeply forked elongately cuneate-flabelliform blade, 30—40 cm. long, chalky white or slightly ferruginous beneath; its divisions are 4–5 cm. broad and have 7—9 costae. The *inflorescence* is diffusedly panicled, apparently 50—60 cm. long (or at times more?), twice branched, each primary branch starting from the sheath of a reduced leaf, which is furnished with its inflated ocrea. often, however a rudimentary one; at times, and especially at the base of the uppermost branches, the leaf is represented by a simply clawed, flagelliform rhachis, to which a few leaflets are attached. The

lowest primary branches are flexuous, 30—50 cm. long, divided into 3–4 secondary spike-bearing branches in their lowest part, and bearing simple spikes above; both the secondary branches and spikes spring from the inside of tubular, closely-sheathing, smooth (or almost so) secondary spathes, which have truncate mouths, and are slightly produced and acute or acuminate at one side, and marcescent in their upper part at the fruiting stage. The *spikes* are spreading, flexuose, 10—14 cm. long, and when carrying the flowers are 14–15 mm. in diameter; after the fall of the flowers they have a tomentose appearance and are 5—8 mm. in diameter. *Flowers* hermaphrodite, very regularly arranged in several spirals, solitary at the axilla of every spathel; the spathels are bracteiform, free, concave, considerably broader than high, very obsoletely apiculate, otherwise rounded, ciliolate, often split, striately veined, besprinkled with furfuraceous scales in their upper part; the two exterior floral bracteoles are falcate, strongly hairy-paleaceous; another more internal is also strongly hairy-paleaceous and a third is reduced to a tuft of hairs. Flower buds when ready to open, are oblong, obtuse, a little attenuate at the base, subterete or very obsoletely trigonous, 5·5 mm. long, and 3 mm. broad in their upper part, and half exserted from the tomentum; the calyx very small and short, 1 mm. high, membranous-hyaline, divided down to the middle into 3 broad, obtuse lobes; the corolla several times longer than the calyx, divided in its upper two-thirds into 3 oblong, cartilaginous, finely striately veined segments, entire, campanulate and embracing the ovary in its lower part. Stamens 6; the filaments connate below with the undivided part of the corolla, and having only a short thickish free part at the throat; the anthers basifixed, elongate equally narrowing towards both ends, very shortly disjointed at the base, having a rather broad connective, and the cells laterally dehiscent. Ovary oblong, attenuate to a conspicuous conically elongate style, slightly shorter than the stamens, terminated by 3 connivent subulate stigmas. *Fruit* ovoid-elliptical or slightly obovoid, suddenly and finely apiculate or mucronate, and pungent at apex, 15–16 mm. long, 10–11 mm. broad; on the whole the pericarp is thin and brittle; the mesocarp is scantily fleshy; the scales are in 15 longitudinal series, thin, of a uniform light cinnamon-brown colour, at times very narrowly reddish or discoloured on the edges, almost dull, about as long as broad, regularly convex, slightly furrowed along the centre, the margins minutely erose-ciliate, the point short and obtuse. *Seed* erect, ovoid-elliptical, terete, equally rounded at both ends, 9 mm. long, 7 mm. broad; its surface even (not pitted), but marked by 6 slightly impressed longitudinal veins; the hilum basal; the albumen deeply ruminate, with, on the chalazal side, a deep globular intrusion of the integument; the embryo relatively large, penetrating the third part of the entire seed, placed in the middle of the side opposite to the intrusion of the integument.

HABITAT.—Rather common in the primeval forests of the Malay Peninsula, of Sumatra, and Borneo. In Singapore; Garden Jungle (*Ridley* No. 9217) and Bukit Timah (*Ridley* No. 6272—specimen in fruit). Malacca: (*Griff.*), Suñgei Udang (*Goodenough* No. 1704—with flowers). Perak (*Wray* No. 1917 and *King's Collector* Nos. 8144, 3503, 5047, 3504, 3126, 3722, 6833, and *Scortechini* in Herb. Becc.). Sumatra: Suñgei bulu, Prov. Padang (*Becc.* Pl. Sum. No. 893); Palembang (*Heyne* No. 22 in Buitenzorg Herbarium). Borneo: Sarawak on Mt. Mattang (*Becc.* P. B. No. 1916)

and on Mt. Poe (*Becc.* P. B. No. 2443), Pontianak (*Heyne* No. 2535 in Buitenzorg Herbarium). Bandjermasing (Buitenzorg Herbarium 13).

Ridley writes that the Rattan of this *Korthalsia*, known under the name of "Rotang Sumut" (or the Ant–Rattan) is valued on account of its small size and strength. In Sarawak, however, the Rattan is considered of bad quality and receives the name of "Rotang Undang."

Observations.—This is one of the characteristic myrmecophilous or Ant–harbouring *Korthalsias*, and its inflated ocreas a species of *Camponotus* in Borneo, and the *Iridomyrmex hospes* in Sumatra, make their abode, penetrating inside through holes, made by the ants themselves, in the wall of the ocrea, or by means of erosions on their margins (see Beccari, Malesia, ii, p. 63, 68).

K. scaphigera is characterized by its slender stem; by the leafsheaths having small but well formed elliptical inflate ocreae, more or less armed with short conical or tuberculiform prickles; by the leaves having few cuneate leaflets, more or less glaucescent beneath, and only those of the uppermost leaves ansate, the others attached to the rachis by means of an acute base, having a callosity (or nectariferous cushion ?) in the axillas; by the tomentose spikes; by the ovoid, mucronate and pungent fruit, and by the ruminated seed.

It is a variable plant. The sheathed stem in a specimen of Scortechini from Perak is 17 mm. in diameter; in one from Palembang in Sumatra it is only 5 mm. The leaves vary in the size and shape of the leaflets, more or less elongate or even rhomboidal. The dimensions of the fruit given above are taken from Ridley's No. 6272. In King's Collector No. 3503 from Perak, the fruit is considerably larger, measuring 22–25 mm. in length and 17 mm. in diameter, and the seed is 15 mm. long and 11 mm. across; otherwise the structure is the same as in the other.

Plate 64.—Korthalsia scaphigera *Mart.*—Portion of the stem and an entire leaf; the intermediate part of the plant from one of Scortechini's specimens collected in Perak (Herb. Beccari); partial inflorescence, bearing spikes with fully developed flower buds. From Goodenough's No. 1704 in Herb. Beccari.

Plate 65.—Korthalsia scaphigera *Mart.*—An almost entire fruiting panicle and the upper part of an adult plant. From Ridley's No. 6272 in Herb. Beccari.

Plate 66.—Korthalsia scaphigera *Mart.*—Portion of the stem with an entire leaf from the upper part of the plant, and a branch of the fruiting spadix; very young plant with primordial leaves. From Beccari P. B. No. 2493. Fruits and seeds, one seed cut longitudinally through the embryo; from King's Collector No. 3503.

See also the analytical plate IV, figs. 9–15 representing the analyses of the flower and fruit of *K. scaphigera* Mart.

2. Korthalsia scaphigeroides Becc. Notes on Philip. Palms II, in Philip. Journ. Science, Botany, iv, (1909) 619.

DESCRIPTION.—Slender. *Sheathed stem* 15–20 mm. in diameter. *Leaf-sheaths* armed with short conical prickles. *Ocreae* inflate, elongate-elliptical or cymbiform, bluntish or apiculate, 7 to 10 cm. long, 15–25 mm. broad, rigid-papyraceous, cinnamon-brown and polished inside, armed with short scattered semi-conical horizontal prickles. *Leaves* of young plants non-cirriferous, ending in a flabellate bilobed leaflet, and having the side-leaflets obsoletely or very briefly ansate; the leaves of adult plants are cirriferous, have the petiole flattened-biconvex, 20 or more cm. long, rather obtuse, usually smooth on the edges, armed beneath, along the centre, with a few solitary claws; rhachis in its intermediate portion armed almost regularly with ternate claws. *Leaflets* few, 4–5 on each side of the rhachis, alternate or subopposite, distinctly ansate, narrowly rhomboidal-cuneate, broadest above their middle, 15–20 cm. long, 4–5 cm. broad, rather acutely praemorse-dentate in their upper margins, and produced at the apex into an acuminate point, green above, mealy-white beneath, and having 7 primary costae. *Spadix* unknown.

HABITAT.—Mindanao; District of Zamboanga (Herb. For. Bur. Manila No. 4816; *Hutchinson*, July, 1906). Nat. name "Tanguguid"; Agusan River, Butuan subprov. (*Merrill* No. 7313, Oct. 1910). Basilan Island (*Hutchinson*, No. 6106, Aug. 1906).

OBSERVATIONS.—This is to all appearances the representative form in the Philippines of *K. scaphigera*, from which it differs in the much more elongate ant-harbouring ocreas, and in the leaves having the leaflets conspicuously mealy-white underneath. The ocreae in the Herbarium specimens show clear evidence of their having been inhabited by ants, for as in *K. scaphigera*, they have a round hole or gate in their upper parts, and several narrow fissures at several points, probably for the admission of air into the lodging.

PLATE 67.—Korthalsia scaphigeroides *Becc.*—One non-cirriferous leaf, and another cirriferous from the upper part of the plant. From Merrill's No. 7313 in Herb. Beccari.

3. KORTHALSIA ECHINOMETRA Becc. Malesia, ii, 66 and 276; Hook. f. Fl. Brit. Ind. vi, 474; Ridley, Mat. Fl. Mal. Penins. ii, 215.

K. angustifolia β gracilis Miq. De Palm. Arc. Ind. 16; Becc. Malesia, ii, 70, 276.

Daemonorops ochreatus Teysm. et Binn. Cat. Hort. Bot. Bog. (1866), 74, (nomen).

Calamus (sect. *Daemonorops*) *ochreatus* Miq. De Palm Arc. Ind. 29 (nomen).

DESCRIPTION.—High scandent and rather slender. *Sheathed stem* 12—20 mm. in diameter; the naked canes have a dull surface. *Leaves* elongate, those of the upper part of full grown plants about 1 m. long in the pinniferous part, and terminated by a clawed cirrus about as long or longer. *Leaf-sheaths* short, more or less partially covered with a tobacco coloured scurf, almost entirely enwrapped by their ocreae, and in their short upper free part more or less spinous. *Ocreae* conspicuously inflate-cymbiform or elliptical, more or less elongate, at times ovoid,

blunt, 10—15 cm. long and furnished with a short, terete, closely sheathing pedicelliform base; the inflated part thinly coriaceous, partially scurfy or glabrescent, armed all round with spreading, scattered, very slender, and very sharp, elastic, laminar, blackish, glossy spines, 3—8 cm. long. Petiole flattened-biconvex, elongate, prickly on the edges. Rhachis armed in its lower part with single, and upwards with 2-3-nate claws. *Leaflets* numerous, 12—15 on each side of the rhachis, opposite or alternate, conspicuously discolourous, white beneath, 3—4 costulate, elongate, linear-lanceolate, narrowing above, acute at the base and not ansate; some of them have the apex toothed, the teeth being narrow, very acute, and aristate; others are very acuminate and have the apex often indented, especially on its lower margin; transverse veinlets very sharp; main costae smooth or occasionally sparingly spinulous above; the intermediate leaflets are 30—35 cm. long and 15—25 mm. broad, the upper ones gradually smaller. *Spadix* much branched and diffuse; the branches robust, arched; spathes cylindrical, closely sheathing, smooth, obliquely truncate at the mouth, and produced at one side into a triangular acute point. *Spikes* cylindrical, usually 15-20 cm. long, 12 mm. in diameter; the spathels are suborbicular, concave, strongly striately veined in the covered part, and have their obtuse roundish point briefly exerted from the wool of the flower bracteoles; the latter have a very small limb completely hidden by an abundant wool. *Flowers* small, 8 mm. long; the calyx very small 3-lobed; the corolla has the petals oblong, obtuse, deciduous. *Fruit* broadly ovoid from a rounded base, conically and very acutely beaked, 13—14 mm. long, 1 cm. broad (immature), squarrose; the scales are in about 20 longitudinal series, uniformly cinnamon-brown, flattish, not furrowed along the centre, margins and tips coarsely erose-toothed or sublacerate. *Seed* too young in the specimen seen by me to make certain of the nature of its albumen.

HABITAT.—A rather common palm, growing in the Malay Peninsula, in Borneo, Sumatra, and Bangka. In the Malay Peninsula: Negri Sembilan (*Ridley*); Perak (*Scortechini* No. 458b in Herb. Becc.); Singapore (*Ridley* No. 3521). Borneo: in Sarawak on Mt. Mattang (*Becc.* P. B. No. 1935); on the Barram River (*J. Hewitt* in the Herbaria at Kew and Manila—fruiting specimens); Bandjermasin (Collector of the Buitenzorg Garden No. 21). Sumatra: in the Residency of Palembang at Komering Ulu (*Grashoff* No. 572) and at Lematang ulu (*Grashoff* No. 197—fruiting specimens in Herb. Buitenzorg and Beccari). In Bangka at Klinju (*Grashoff* in Herb. Buitenzorg and Beccari). Native name in Singapore "Rotang Udan," in Perak "Rotang Sumut" (Scortechini), in Palembang "Uri udang" or "Uri Semot" (Grashoff). In Sarawak the Dyaks name for it is "Rotang Rua" and it is employed for the same purposes as "R. Cheb."

OBSERVATIONS.—A very conspicuous and easily recognizable species on account of its large inflated ocreae, armed with very long spreading slender spines, and of the leaves having numerous narrow discolourous leaflets.

The specimens from Borneo have the leaflets with the main nerves smooth, whereas in the specimens from Sumatra the same nerves are more or less spinulous. The Sumatran specimens have also the ocreae armed with shorter, more slender and less numerous spines.

In a specimen from a plant cultivated in the Botanic Garden of Buitenzorg, under the name of *Daemonorops ochreatus* Teysm. the ocreae are very large, ovate, much inflated (4 cm. wide) and powerfully armed, but this specimen apparently was detached from the uppermost part of the stem, immediately below the terminal inflorescence, where, as in other spines, the ocreae are larger and broader than elsewhere. There is scarcely any doubt as to the identity of *K. angustifolia β. gracilis* Miq. with *K. Echinometra*; it was described from sterile specimens collected by De Vriese in Palembang (Sumatra), vernacular name "Baku."

PLATE 68.—Korthalsia Echinometra *Becc.*—Intermediate portion of a plant showing two ocreae and a detached portion of the leaf belonging to it; from P. B. No. 1935. Leaf-sheath and its ocrea and leaf from Scortechini's No. 458b in Herb. Becc. A separate ocrea, larger than usual, from a plant cultivated at Buitenzorg under the name of *Daemonorops ochreatus.*

PLATE 69.—Korthalsia Echinometra *Becc.*—Leaf and branch of the spadix with fruits not quite mature. From Hewitt's specimens in the Herbarium at Kew.

4? KORTHALSIA HORRIDA Becc. Malesia, ii, 66 t. VI.

DESCRIPTION.—Rather slender. *Sheathed stem* 2 cm. in diameter. *Leaves* rather large; one—apparently from a nearly fully grown but not yet fertile plant—is non-cirriferous, and 1·80 m. long. *Leaf-sheaths*, in their upper uncovered part and immediately below the insertion of the petiole, fugaciously and partially rusty furfuraceous and armed with straight, rigid, horizontal, 5–8 mm. long spines; on the sides the spines are flattened and ascendant; on the ventral side the leaf-sheaths are disintegrated into a fibrous net, but otherwise completely enveloped by their respective ocreae. *Ocreae* considerably inflated, 15 cm. long, 3 cm. broad, of a thin or papery-membranous texture, cymbiform or elongate-elliptical, armed all round with scattered, very slender and very sharp, elastic, laminar, blackish spines, up to 12 cm. long, resting on a broad base, and spreading in every direction. Petiole thickish, slightly flattened, in one specimen 60 cm. long, 8–9 mm. thick, armed all round with short, straight prickles; rhachis trigonous, slightly clawed below; the cirrus reduced to a very slender filament. *Leaflets* very numerous, 32 in all in one specimen, subopposite or alternate, elongate-lanceolate or lanceolate-ensiform, very gradually long-acuminate, rigid-papyraceous, very conspicuously discolourous, being deep green above and white beneath, plicately 4–5-nerved; the main nerves spinulous on the upper surface; the lower margin of the apical part also spinulous; transverse veinlets very sharp on the upper surface; the medial and largest leaflets about 50 cm. long, 3–5 cm. broad; the upper ones gradually smaller and considerably shorter. The *spadix* unknown.

HABITAT.—Borneo. Known only from a specimen collected by me in June 1866 on Mt. Mattang in Sarawak (P. B. No. 1918). Native name "Rotang Sabakan."

OBSERVATIONS.—This also is known only from sterile specimens, but possibly represents only a young stage of *K. Echinometra*; as the only leaf preserved belongs apparently to a not full grown plant. The ocreae are very much like those of *K. Echinometra* but of a thinner texture and the leaves have larger and more acuminate leaflets, with the main nerves abundantly spinulous on their upper

surface, a character which I supposed peculiar to *K. horrida*, whereas I have now found that it is occasionally possessed also by *K. Echinometra*.

PLATE 70.—Korthalsia horrida *Becc.*—The entire typical specimen P. B. No. 1918 in Herb. Beccari.

5. KORTHALSIA CHEB Becc. Malesia, ii, 67.

DESCRIPTION.—Of middling size. *Sheathed stem* 1·5–2 cm. in diameter. *Leaves* large, 2·5 m. long including the cirrus. *Leaf-sheaths* completely enwrapped by the ocreae, except along a narrow strip on the back, which is armed with a line of rather stout, 8–10 mm. long, straight horizontal spines. *Ocreae* very large, surpassing in length the sheaths they enwrap, 28 cm. long in one specimen, closely sheathing in their basal part, for an extent of about 5 cm., cylindrical, and disintegrated along the ventral side into a fibrous net; in all the other specimens the ocreae are somewhat inflated, cylindrically cymbiform, 2·5 cm. broad, have the apices obtuse, are so thickly coriaceous as to be almost woody, glabrous, almost polished and armed only with a few scattered broad-based horizontal prickles. The petiole is about 30 cm. long (in one leaf), flattened, armed on the edges with distant horizontal spines, and below with some solitary claws. The pinniferous part is about 80 cm. long; its rhachis trigonous, partially and fugaciously furfuraceous, armed below with claws, at first single, then geminate and finally ternate. The cirrus is rather irregularly clawed. *Leaflets* 6 on each side (in one leaf), obliquely elongately-rhomboidal with a cuneate base, briefly ansate, with apices acute or shortly caudiculate, papyraceous, green and rather dull above, conspicuously chalky-white beneath; the upper margins sinuously not deeply toothed, the teeth acute or occasionally subaristate; the largest leaflets, the intermediate, are 30–40 cm. long, and 10–15 cm. broad; those of the extremities somewhat smaller. *Spadix* unknown.

HABITAT.—Borneo: in Sarawak on Mount Mattang (*Becc.* P. B. No. 1936). It has been collected again by *Dr. Hallier* in Dutch Borneo on the Sungei Kenepai (No. 2019 in Buitenzorg Herbarium).

OBSERVATIONS.—Imperfectly known, nevertheless very distinct from the other species by its not very inflated but extraordinarily elongate and very hard ocreae. It approaches *K angustifolia*, but this has much narrower leaflets and ocreae with thinner walls. The specimens collected by Hallier are somewhat smaller than the type specimen from Sarawak, but otherwise very similar in the leaves and nature of the ocreae. On E ocrea in Hallier's specimens is 14 cm. long, and 2·5 cm. broad. The sheathed stem is 15 mm. in diameter.

In Sarawak it receives the name of "Rotan Cheb," and the canes are much valued by the Dyaks; the strips obtained from them, being very strong, are used especially for basket work and on account of their extraordinary toughness for fastening axe heads to their handles.

PLATE 71.—Korthalsia Cheb *Becc.*—The type specimen in Herb. Beccari.

6. KORTHALSIA SCORTECHINII Becc. in Hook. f. Fl. Brit. Ind. vi, 475.

DESCRIPTION.—Rather slender. *Sheathed stem* 12–17 mm. in diameter. *Leaves* rather large, one cirriferous is about 45–60 cm. long in the pinniferous part.

Leaf-sheaths entirely enveloped by the ocreae, except in a small upper portion which is armed with scattered, very short subtuberculiform spines. *Ocreae* very large, terete, and closely sheathing in their basal (3–4 cm. long) part, otherwise somewhat inflated and elongate–cymbiform, the inflated part is 12–18 cm. long, and 2·5—3 cm. broad, obtuse at apex, unclosed above on the inner side, otherwise completely clasping the following sheath, thinly coriaceous, glabrous, armed with scattered, thickish, horizontal, short (6–7 mm. long at most) spines ; Petiole flattened, slightly biconvex or flattish above and convex below, armed irregularly with small claws on the edges, and more or less also below, in one specimen 8 cm. long, in another 22 cm.; Rhachis armed with scattered single claws ; Cirrus slender, irregularly clawed. *Leaflets* rather numerous, 10–11 on each side of the rhachis, equidistant, alternate or subopposite, a few of the lowermost more approximate than the others, papyraceous, green above and whitish beneath, cuneately elongate-oblanceolate, 5–7–nerved, the upper ones acutely toothed in their upper margins and very acuminate, 35–40 cm. long, 4–5 cm. broad ; the lower smaller, somewhat attenuate above, toothed and very irregularly only at the apex. *Spadix* unknown.

Habitat.—In the Malay Peninsula at Perak ; collected only by Father *Scortechini*. Native name "Rotang Udang." This is the vernacular name for several species of *Korthalsia* with inflated elongate ocreae, in which the Malays see a fancied resemblance to the "Udang" the Malay name for a Prawn.

Observations.—This species is characterized by its very large elongate ocreae, armed only with short prickles, and by its numerous narrow discolourous leaflets. The ocreae are very similar to those of *K. Cheb*, but have a much thinner texture ; the leaves also have narrower leaflets.

Plate 72.—Korthalsia Scortechinii *Becc.*—The type specimen in Herb. Beccari.

7. Korthalsia angustifolia Bl. Rumphia, ii, 172 ; Mart. Hist. Nat. Palm. iii, 211 ; Miq. Fl. Ind. Bat. iii, 77 ; Becc. Malesia ii, 70 (excl. *K. flagellaris* Miq.) p. 275 t. LXIV, f. 1, 2.

Description.—Of moderate (or relatively large ?) size. *Sheathed stem* 2·5 cm. in diameter, (or probably more in full grown plants). *Leaf-sheaths* thinly and fugaciously rusty–furfuraceous and somewhat whitish pruinose, armed rather densely on their backs, and scantily on the ventral aspect, with scattered straight spines, 3–10 mm. long. *Ocreae* inflated, not very thickly coriaceous, elongate-cymbiform or fusiform, narrowing above to a bluntish apex, 15-20 cm. long, 2–2·5 cm. broad, also slightly pruinose and fugaciously scantily rusty-furfuraceous, thinly coriaceous, very sparingly armed with a few short spines. The *leaves* of the adult plants are described by Blume as cirriferous, 2–2·5 m. long including the cirrus, and bearing 15–18 *leaflets* ; the latter are distinctly ansate, 20–30 cm. long, 2·5–4 cm. wide, cuneately-oblanceolate, very acuminate, 7–10-nerved, almost shiny above, and covered beneath with a thin coating of yellowish-white or almost chalky indumentum ; the upper margins are sharply toothed, and the teeth subulate-aristate. The leaves of young plants are non-cirriferous, and end in a flabellate leaflet ; the largest of these leaves seen by me measures 1·5–1·8 m. including the

petiole, and has 10–11 leaflets on each side; the petiole is elongate and thickish, about 1 cm. broad, flattish above, angular-convex below, with obtuse edges, and is armed on its upper surface and on the back, especially in its lower portion, with small prickles. The leaflets are as described above, but somewhat larger, attaining 30–40 cm. in length and 8–9 cm. in breadth. In very young plants, which however also show the characteristic ocrea, the leaves have a petiole up to 70 cm. in length, very prickly all round, with very few leaflets on each side of the rhachis and a rather large terminal flabellum. *Spadix* unknown.

Habitat.—South Borneo. The original specimen, upon which Blume founded the species, was collected on the Dusson by *Korthals.* It has been found again recently at Bandjermasin by the collectors of the Botanical Garden of Buitenzorg (No. 48 in the Herbaria of Buitenzorg and Beccari).

Observations.—It is a very imperfectly known species, but nevertheless well characterized by its large, very elongate, not very thickly coriaceous, sparingly prickly ocreae, and by the cuneately oblanceolate leaflets, chalky-yellowish beneath and having very sharply toothed margins. The specimens I received from Buitenzorg are all sterile, and bear non-cirriferous leaves, but are undoubtedly conspecific with the type of Blume, which I have seen.

The variety *gracilis* Miq. of *K. angustifolia* Bl. is referable to *K. echinometra* Becc. (See observations on that species.)

Plate 73.—Korthalsia angustifolia *Becc.—Leaf-sheath* with its ocrea, and the base of a leaf; portion of a leaf near the end. Specimen from a young plant with non-cirriferous leaves, in Herb. Beccari (No. 48 in Buitenzorg Herbarium).

8. Korthalsia furcata.—Becc. sp. n.

Description.—Very small. The naked *stem* is only 2 mm. in diameter and 5–6 mm. with the sheaths on. *Leaf-sheaths* very short, the leaves being very approximate and gradually passing into the petiole, polished, thickish on their backs where they are furnished with some short spines, or at times quite smooth, and disintegrated along the ventral aspect into a fibrous net. *Ocreae* relatively to the size of the plant conspicuous, inflated, ovate-elliptical or oblong, very similar to those of *K. scaphigera*, 20—25 mm. long, 8–10 mm. broad, smooth or furnished with some spinules near the acute apex. *Leaves* small, on the whole 30–40 cm. long; the blade is very simple, very deeply forked with a cuneate acute base, or formed only of two segments, united to the extent of 2–4 cm. at their bases, and separating at a very acute angle, so as to leave between them a deep and narrow V shaped sinus; from the sinus springs a fine filament or rudimentary cirrus, at times up to 10–12 cm. in length, and finely aculeolate; the segments of the blade are broadly linear or almost all of a uniform breadth of 18–25 mm. and 25–30 cm. in length, sharply 3–5-costulate, distinctly discolourous, green and shiny above, ashy gray beneath, very slightly attenuate towards the apex, which is nearly truncate, irregularly and boldly toothed, the teeth being rather obtuse, and decreasing in steps along the outer margin the transverse veinlets are very fine and distinct on the upper surface and almost obsolete on the lower. The petiole

is slender, 5–10 cm. long, 2 mm. broad, polished, subtrigonous, flat above, armed with a few small claws and obsoletely angular below. In the Herbarium specimens the leaves acquire a chestnut-brown colour. *Spadix* unknown.

LATIN DIAGNOSIS.—Korthalsia furcata *Becc.* sp. nov.

HABITAT.—Discovered by Dr. *Hallier* on Sungei Kenepai during the Dutch Expedition in Borneo, 1893-94 (No. 2034 in Buitenzorg Herbarium).

OBSERVATIONS.—The specimens from which the description of this quite distinct little *Korthalsia* is derived consist of the upper parts of plants not in flower, and apparently not quite fully grown, but which however have, seemingly, attained their definitive characters. The forked leaves which in other species (in *K. scaphigera* for instance) are produced only in the primordial stage of the plant, are apparently in *K. furcata* definitive, and afford a diagnostic character unique among all the *Korthalsias* known up to the present day, that is if in the last and flowering period pinnate and cirriferous leaves are not produced.

PLATE 74.—Korthalsia furcata *Becc.*—The entire upper part of a plant ; a detached leaf ; (from Hallier's No. 2034 in the Buitenzorg Herbarium).

Parvula, caudice tenuissimo ; vaginis brevibus laevibus vel parcissime spinosis, ocrea inflata ovato-elliptica ; frondibus brevissimis, petiolo gracili, limbo simpliciter profunde furcato, sive segmentis duobus basi unitis late linearibus, 3–9-costulatis composito.

9. KORTHALSIA PAUCIJUGA Becc. sp. n.

DESCRIPTION.—Slender. *Sheathed stem* 8–10 mm. in diameter. *Leaf-sheaths* slightly and fugaciously rusty-furfuraceous, armed only along a narrow ventral line, with a few small straight spines, otherwise smooth. *Ocreae* short, 10–15 mm. long, closely sheathing, smooth or very sparingly prickly, truncate, coriaceous at the base, and thinly membranous, ragged and perishable in their upper part. *Leaves* small, 18—28 cm. long in the pinniferous part, having only 3 leaflets on each side of the rhachis, and ending in a very slender, very minutely clawed cirrus. Petiole very short, distinctly callose at its axilla, 10–25 mm. long at most ; the rhachis rusty-furfuraceous, especially in its lower part, and armed with few relatively strong claws. *Leaflets* alternate, rigid-papyraceous, glossy above, subconcolourous but dull below, more or less ferruginously powdery at their basal part and besprinkled all over with very minute ferruginous dots, visible only under a good lens ; in shape the leaflets are cuneately-oblong or sub-rhomboidal-cuneate, are very irregularly and boldly and obtusely sinuate-toothed on their upper margins, and have the apex prolonged into a lengthened acumen ; the sides below the toothed part are slightly curved in converging to the base, and not quite straight, as is usually in other species, in *K. rigida* for instance, which the leaflets of *K. paucijuga* in other respect resemble ; the main nerves are 5, but usually only 3 are distinctly prominent ; transverse veinlets very numerous, approximate, fine, and, as in allied species pellucid ; in every leaf the lower pair of

leaflets are 15–22 cm. long, and 4-5·5 cm. wide; the upper ones are somewhat smaller, 10–15 cm. long and 3–4·5 cm. broad; the ansae are 6–10 mm. long, rusty-furfuraceous, somewhat flattened, callose in their axillas. *Spadix* unknown.

Habitat.—Dutch Borneo. First collected by *Teysmann* (No. 16714 in Buitenzorg Herbarium), who gives the native name "Djelundengan." Found again recently by *Heyne* at Bandjermasin (No. 24 bis in Buitenzorg Herbarium) and at Pontianak (No. 2544 in Buitenzorg Herbarium).

Observations.—It is a slender palm, somewhat resembling *K. rigida*, from which it is easily distinguishable by the short ocreae, perishable in their upper part, but not forming a fibrous net; by its short leaves having very short petioles and only 6 leaflets in all; by the leaflets being rather distinctly 3-costulate, and having the sides in the cuneate lower part slightly curved in converging towards the base, and not, as usual, quite straight; they are also, more distinctly than in other species, dotted below.

Probably the specimens of *K. rigida* mentioned by Blume (l.c.), as collected by *Korthals* in Borneo belong to *K. paucijuga*.

Plate 75.—Korthalsia paucijuga *Becc.* The terminal part of a plant. From Heyne's No. 24 bis in Buitenzorg Herbarium.

Latin Diagnosis.—Korthalsia paucijuga *Becc.* sp. nov.—Gracilis; vaginis fugaciter furfuraceo-rubiginosis, parce in ventre spinulosis; ocrea brevi, marcescenti; frondibus parvis, brevissime petiolatis, segmentis perpaucis, breviter ansatis, oblongo-cuneatis, apice acuminato-caudato, 3-costulatis, superne virentibus et nitentibus, subtus pallidioribus et squamulis punctiformibus minutissimis ferrugineis obsitis.

10. Korthalsia debilis Bl. Rumphia, ii, 169 et iii, t. $\frac{157}{B}$, A; Mart. Hist. Nat. Palm. iii, 211; Miq. Fl. Ind. Bat. iii, 75, and Prodr. Fl. Sum. 255, and De Palm. Arc. Ind. 26; Walp. Ann. iii, 492; Hassk. Cat. Hort. Bot. Bogor, 1866, 73; Becc. Malesia, ii, 70.

Description.—Very slender. *Sheathed stem* 5–10 mm. in diameter, the canes with a dull (non-vitreous) surface. *Leaf-sheaths* elongate, fugaciously and partially rusty-furfuraceous, usually sparingly, yet at times rather thickly, armed with very short tuberculiform spines or quite smooth, coriaceous, but of a flabby structure along the ventral or outer aspect, especially in their upper part where usually disintegrated into a fibrous net. *Ocreae* 3–8 cm. long on the whole, more or less armed with short ascendant prickles, or otherwise smooth, closely sheathing, but having a short permanent coriaceous base, and thinly membranous and more or less disintegrated into a fibrous, finally deciduous net in the remainder. *Intermediate leaves* 30–35 cm. long in the pinniferous part, ending in a cirrus about as long, very slender, and very minutely clawed. Petiole short, 2–3 cm. long or longer in leaves of young plants, flattish or slightly concave above, rounded below. Rhachis armed with scattered, small claws. *Leaflets* 4–5 on each side of the rhachis, alternate, papyraceous, whitish beneath, especially when young, 15–18 cm. long, 4–6 cm. broad, cuneate-rhomboidal, or triangular above the middle or in their upper third part, and gradually cuneate below; their upper

margins undulate and praemorse–toothed; the apex usually produced and caudate; main nerves 6–7, slender, the central one slightly stronger than the others; transverse veinlets very fine; ansae strongly flattened, 5–6 mm. long. The *lower leaves* have longer petioles, and apparently a few more leaflets. The *leaves* near the infloresence are much reduced in length, and have considerably smaller leaflets. *Inflorescence* narrowly panieled, about 30 cm. long, composed of a very few appressed, undivided branches, bearing very few erect spikes; spathes tubular, narrowly infundibular, closely sheathing, smooth or very slightly spinulous, produced above to a broad membranous acuminate limb embracing the base of the spikes, and finally marcescent. *Spikes* slender, flexuous, 10—15 cm. long, and when bearing flowers 10 mm. in diameter but only 5–6 mm. when without them, and then of a somewhat tomentose appearance; spathels concave, broader than long, often connate by their sides, striately veined, their upper margins rounded and ciliolate, and slightly produced above the dense light coloured wool to which the floral bracteoles are almost entirely reduced. *Flowers* clavate–oblong, rounded above, 4 mm. long, 2·5 mm. broad; the calyx nearly half exserted from the wool of the bracts, thinly cartilaginous, urceolate, deeply parted downwards into 3 ovate–obtuse lobes, polished externally; the corolla nearly 3 times as long as the calyx, deeply divided into 3 cartilaginous segments, faintly striately veined externally, contracted at the throat, entire and slightly ventricose in its lower part; the stamens have very short and thick filaments, united at the throat of the corolla, and broadly lanceolate–sagittate, acute anthers; ovary ovoid, narrowing above to a short, conical, sulcate, acute style, reaching only to the base of the anthers; stigmas very minute, punctiform. *Fruit* small, globular, 10–11 mm. in diameter rounded at both ends, shortly but acutely beaked at apex; the pericarp on the whole thin and brittle; mesocarp very sparingly fleshy; scales in 17–18 longitudinal series, slightly convex, not deeply grooved along the centre, reddish brown, the apex obtuse and blackish and slightly produced, the margins and especially the apex conspicuously ciliate–fringed. *Seed* globular, 6–7 mm. in diameter, its surface brownish, slightly uneven and marked with 6–7 very faintly impressed longitudinal veins; hilum basilar; lateral intrusion of the integument deep and broad; albumen homogeneous, curved, crescent–like in longitudinal section.

Habitat.—Sumatra, in the Province of Padang (*Korthals*); in the Prov. of Palembang (*Heyne* No. 13 in Buitenzorg Herbarium and *J. A. van Rijn van Alkemade* in Herb. Martelli). Borneo on Mt. Mattang in Sarawak (*Becc.* P. B. No. 1914).

Observations.—I have based the description of this species on specimens gathered from plants cultivated at Buitenzorg, under their right name of *K. debilis*, and introduced from Palembang. Nat. name "Rotang dahan", a name, however, applied to several of the non-ocrigerous *Korthalsias*. Korthal's type specimen has leaves bearing 6 pairs of leaflets, almost regularly rhomboidal, but longer than wide, and having undulate, obsoletely toothed upper margins. Heyne's specimens No. 13 are also sterile and have leaves with 12 leaflets, sharply toothed on the upper margins; in one of these specimens the leaf sheaths are nearly unarmed, in another are rather closely prickly. On the whole *K. debilis* appears a rather

variable plant in the spinescence of the leaf-sheaths, and in the number and shape of the leaflets, these being more or less long-attenuate to a cuneate base and having more or less sharply toothed margins. Probably the young not fertile plants have leaves with more numerous leaflets than the adult ones.

The species is well characterized by its slender habit, and leaves bearing 8—12 cuneately rhomboidal leaflets ; by its ocreae elongate, closely sheathing, dissolved above into a fibrous net ; by the small inflorescence with very few short branches bearing few erect spikes ; by the flowers oblong-clavate ; by the small globose fruits ; and by the spherical seed with homogeneous albumen.

The specimen of the P. B. No. 1914, which I have considered as belonging to *K. debilis*, has also leaves with 6 pairs of leaflets and a very slender cirrus, otherwise it is in every respect very similar to Korthals's type specimen of *K. debilis*, but being sterile some doubts remain about its identification.

PLATE 76.—Korthalsia debilis *Bl.*—Portion of the stem with an entire leaf ; the end of a flowering plant ; portion of the spadix in flower ; another portion with mature fruits. From plants cultivated at Buitenzorg (Herb. Beccari).

11. KORTHALSIA RIGIDA Bl. Rumphia, ii, (1836) 167, t. 157 ; Mart. Hist. Nat. Palm. iii, 211,343 ; Miq. Fl. Ind. Bat. iii, 79 ; De Palm. Arc. Ind. 26 (excl. *K. Lobbiana* H. Wendl.) : Prodr. Fl. Sum. 255 ; Walp. Ann. iii, 492 ; Hassk. Cat. Hort. Bot. Bogor. (1866) 73 ; Becc. Malesia, ii, 73 ; Kurz in Journ. As. Soc., Beng. xviii (1874) 207.

K. polystachya Mart. Hist. Nat. Palm. iii. 210. 343, t. 172. Fig. 1 et Z. XIII ; Miq. Fl. Ind. Bat. iii, 77 ; Becc. Malesia, ii, 74 ; Hook. f. Fl. Brit. Ind. vi, 476.

Calamosagus polystachyus Griff. in lit. ad Mart. 1846 ex Mart. l. c. 211 ; *C. ochriger* Griff. Palms Brit. Ind. pp. XII. 31. t. CCXVI. 1.

DESCRIPTION.—Slender and high scandent. *Sheathed stem* 12—18 mm. in diameter. *Leaf-sheaths* quite smooth, or armed (along the ventral side only) with small and very short prickles. *Ocreae* of old leaves cylindrical, coriaceous, closely sheathing, 1—2 cm. long, irregularly truncate at their mouths, unarmed or slightly prickly on the ventral side ; in newly expanded leaves, and especially in young plants the ocreae are prolonged into a thinly membranous upper part, some centimetres in length, more or less disintegrated into a fibrous net, and finally entirely destroyed, leaving only its short truncate, coriaceous base. Intermediate *leaves* of the adult plant 40—50 cm. long, ending in a clawed cirrus about as long or shorter. Petiole very short, 2—4 cm. long, or at times almost reduced to nothing, distinctly callous at its axilla. Rhachis rather powerfully clawed. *Leaflets* 5—6 on each side of the rhachis, alternate, rigid, thinly coriaceous, green and almost glossy above, slightly paler or subglaucous beneath, somewhat asymmetrically cuneate-rhomboidal, 15—18 cm. long, 5—7 cm. wide, the upper margins irregularly undulate and erose-toothed, the apex acute or acuminate ; main nerves 6—7, slender, the central one more prominent than the others ; transverse veinlets numerous, pellucid and not very prominent ; the ansae are slightly rusty furfuraccous, 10—15 mm. long, not or slightly flattened, and have a thickish base, apparently fleshy in the living plant. The uppermost leaves (especially those nearer to the inflorescence)

are, as usual, smaller, have a shorter cirrus and smaller leaflets (8—10 cm. by 3·5—4 cm.), are more briefly cuneate at the base and more regularly rhomboidal. The primordial leaves are undivided and oblong-flabellate. *Inflorescence* twice diffusedly branched, 1 m. long, and more; the primary branches 50—60 cm. long, divided into several secondary branches. Spathes elongate-tubular, slightly infundibuliform, closely sheathing, unarmed, their mouths truncate and slightly produced at one side into a triangular acute point; the secondary or spike-bearing branches are slender, 3—4 mm. in diameter, 25—30 cm. long, and bear 5—6 spikes. The *spikes* are attached by a slender flattened pedicellar part to the bottom of their respective spathes, but appear to be inserted at the mouth of these; the latter are spreading or recurved, and all more or less turned to one side, very slender, flexuous, 8—10 cm. long, 3—5 mm. in diameter (not taking into account the flowers), and of a glabrous appearance; the spathels are broadly triangular, concave, like a swallow's nest, and suffult the bases of the flowers, obtuse, membranous, strongly striately veined, free (not connate by their margins) and produced beyond the wool of the flower-bracts; it is for this reason that the spikes assume a glabrous appearance; the floral bracteoles are small, almost entirely reduced to dense tufts of short woolly hairs, which make rather deep nest or cup-like involucres to the flowers. *Flowers* arranged in 7 longitudinal series, immersed in their woolly bracteoles by the lower part of the calyx only; the full grown flower buds are 4 mm. long, 2 mm. broad, oblong, terete, obtuse; the calyx is cyathiform, somewhat attenuate at the base, and exserted from the wool of the flower bracteoles, strongly striately veined, parted to the middle into 3, broad, obtuse lobes; the corolla is twice or nearly three times as long as the calyx and is divided nearly to the base into three oblong, externally-striate segments; the stamens have short and thick filaments, united at the base with the corolla, and subulate at the apex; anthers elongate-sagittate, bluntish or apiculate; ovary ovoid, attenuate above to a short and sulcate, conical acute style, reaching with the apex only to a little above the bases of the anthers; stigmas very minute. *Fruit* very small, 8 mm. long, 4 mm. broad, obovoid-turbinate, very suddenly and minutely beaked, narrowing below to a rather acute base; scales very small, 1·5 mm. broad and about as long, arranged in 15 longitudinal series, uniformly brown, convex, deeply furrowed along the centre; the apex blunt, appressed; the margins very finely and densely ciliate. In the specimens at my disposal the fruits are immature, but probably they had attained nearly their definitive dimensions. The *seed*, however, is not fully developed, but apparently the albumen is ruminate.

HABITAT.—Sumatra, the Malay Peninsula, Singapore, Billiton, Bangka, and perhaps Borneo. Blume gives for his *K. rigida* the localities of Sumatra and Borneo. Martius (l. c. p. 343) adds also Java; Miquel (Prodr. Fl. Sum. l. c.) mentions Padang in West Sumatra. It is quite possible that this species grows also in Borneo, as it has been found in Billiton (*Heyne* No. 4 in Buitenzorg Herbarium) the island between Borneo and Sumatra, and in Bangka at Klinju (*Grashoff* No. 60 in Herb. Buitenzorg and Becc). It is on the Billiton specimens that I have based the description of the fruit, and it is the specimens coming from this place as from Sumatra that particularly represent the typical *K. rigida* Bl.; whereas the specimens that are really to be considered as belonging to *K. polystachya* are Griffith's from

Malacca, and those from Singapore at Bukit Timah (*Ridley* No. 8782—Herb. Beccari), from Batu Pahat in Johore (*Ridley* No. 11208—Berlin Herb.), and from the State of Pahan (*Ridley* No. 13298—Herb. Beccari).

Observations.—A slender species, characterized by the leaf-sheaths which are smooth or only sparingly prickly; by the ocreae being closely sheathing, having a short coriaceous basal part, and the remainder fibrous and perishable; by the leaflets being cuneately-rhomboidal, subglaucous on the lower surface or only paler than above; by the spikes being very slender and of a glabrous appearance on account of the spathels projecting considerably from the wool of the flower-bracteoles; by the flowers having the calyx attenuate at the base, and about half exserted from the wool of the flower bracts, and finally by the very small turbinate fruit having a ruminate seed.

After a very careful study I have been led to conclude that *K. rigida* Bl. and *K. polystachya* are to be considered as the same species, and I now think that Kurz was not mistaken in uniting them; indeed, as I pointed out in Malesia (l. c.), the plates of *K. polystachya* in Martius (l. c.) and those of *K. rigida* in Blume's Rumphia are extremely alike. Apparently in the plant described by Blume as *K. rigida* the calyx is a little larger than in *K. polystachya*, and therefore the corolla is only twice as long as the calyx, whereas in the specimens coming from the Malay Peninsula, and considered as representing the typical *K. polystachya* (Ridley No. 11208), the corolla is somewhat more than twice or nearly three times as long as the calyx; moreover, in the *K. polystachya* of Martius, the ovary (in full grown flower buds) reaches only to the base of the anthers, whereas in the typical Blume's specimen of *K. rigida* the style attains only to the lower third part of the anthers. Of Blume's typical *K. rigida* the fruit is unknown. Ridley gives for the fruit of *K. polystachya* the length of ⅜ inch (=9·5 mm.), and the not quite mature fruits of the specimens from Billiton referred by me to K. *rigida* are somewhat smaller (8 mm.); the difference therefore is very small.

In the Herbarium at Calcutta there is a specimen of Kurz (No. 2824) named *K. rigida*, to which is assigned the locality of Java. The flowers of this specimen agree exactly with the figures given by Blume in his plate 157, only about the locality there may be some ground for doubt, as the specimens might have been collected in the Buitenzorg Garden and not really in the forests of Java.

Plate 77.—Korthalsia rigida *Bl.*—Primordial leaf from a specimen collected by Prof. Engler at Singapore (Berlin Herb.); portion of the stem with a leaf entire, from Ridley's No. 8782 in Herb. Beccari; branch of the spadix in flower, from Ridley's No. 11208 in Herb. Beccari.

Plate 78.—Korthalsia rigida *Bl.*—Portion of the upper part of the plant bearing the base of the spadix and terminal part of the spadix with nearly mature fruits. Specimen from Billiton (Heyne's No. 103 in the Buitenzorg and Beccari Herbaria).

12. Korthalsia Junghuhnii Miq. in Pl. Jungh. i, 162: Fl. Ind. Bat. iii, 76; De Palm. Arc. Ind. 15, 16; Becc. Malesia, ii, 71.

Description.—Slender and high scandent. *Sheathed stem* 8—12 mm. in diameter. *Leaf-sheaths* at times almost smooth, but usually armed with small and very short

prickles along the ventral side only, especially near the bases of the petioles. *Ocreae* having a short permanent coriaceous base, armed with some prickles on the ventral side, and lengthened above into a closely sheathing brown, membranous appendage 2—4 cm. long in the lower leaves, and shorter in the upper ones; this appendage is later more or less disintegrated into a fibrous, perishable net. *Intermediate leaves* of the adult plant 40—50 cm. long in the pinniferous part, ending in a somewhat shorter and slender clawed cirrus; petiole very short, 2—4 cm. long, broadly concave above, rounded beneath, furnished with a distinct callus and transverse rima at its axilla; rhachis armed with scattered usually solitary, claws. *Leaflets* 5—6 on each side of the rhachis, alternate, rigid, thinly coriaceous, green and almost glossy above, whitish beneath in newly expanded leaves, but later only slightly paler than above, somewhat asymmetrically cuneate-rhomboidal, 15—18 cm. long, 5—7 cm. wide, their upper margins irregularly undulate and erose-toothed, the secondary teeth very minute and acute; the apex acute or somewhat produced; main nerves 7—9, slender, the central one more prominent than the others; transverse veinlets numerous, very fine, continuous and pellucid; the ansae are conspicuous, 10—12 mm. long, minutely rusty-furfuraceous, thickish and swollen at the base. The uppermost leaves, especially those nearer to the inflorescence, are smaller than the intermediate, have a shorter cirrus, and smaller leaflets (8—10 cm. by 3·5—4 cm. or less), and are more shortly cuneate, or more regularly rhomboidal. *Inflorescence* about 50 cm. long, twice branched, but having only 2—3 primary sinuous branches divided into only 2—3 secondary branches. Spathes elongate-tubular, slightly infundibuliform, closely sheathing, unarmed or at times slightly spinulous, their mouths obliquely truncate and slightly produced at one side into a triangular acute point; the secondary or spike-bearing branches are short (10—15 cm. long) and bear only 3 or at most 4 spikes. The *spikes* have a glabrous appearance, are attached by means of a slender, flattened pedicellar part to the bottom of their respective spathes, and have their bases very slightly exserted from these, are alternate, spreading, flexuous, 6—8 cm. long, 5 mm. in diameter, not taking into account the flowers, and 9—10 mm. with them; spathels broadly triangular, concave like a swallow's nest, and suffulting the bases of the flowers, obtuse, membranous, strongly striately veined, free (not connate by their margins), considerably produced beyond the wool of the flower-bracteoles so that the spikes assume a glabrous appearance; the floral bracteoles are almost entirely reduced to dense tufts of short woolly hairs. *Flowers* arranged in 7 longitudinal series, dipping into their woolly bracteoles by the lower part of the calyx only; are 4 mm. long and 3 mm. broad, obovoid, obtuse; the calyx is cyathiform, not or but slightly attenuate at the base, strongly striately veined, parted down to only a little above the base into 3 ovate obtuse lobes; the corolla is twice as long as the calyx or a little less, or divided for two-thirds of its length into three ovate cymbiform segments, striate externally; the stamens have the filaments short and thick, subulate at apex, united below to the entire urceolate base of the corolla; anthers ovate-sagittate, acute; ovary ovoid, narrowing above to a short sulcate conical acute style reaching only to the base of the anthers; stigmas very minute, punctiform. *Fruit* globular or globular-turbinate, a little longer than broad, 16—18 mm. long, 14—15 mm. broad, rounded at the base, the apex very slightly depressed and bearing the very minute remains of the stigmas in the

centre; scales in 15 longitudinal series, of a uniform cinnamon-brown colour, 5 mm. broad and about as long, polished, strongly convex, deeply grooved along the centre, the apex obtuse and very appressed, the margins very narrowly scarious and inconspicuously erosely-ciliolate. *Seed* ovoid, equally rounded at both ends, 10—12 mm. long, 8—9 mm. broad, detachable from the pericarp, having a glossy slightly uneven, (not pitted) surface, only marked longitudinally and slightly with some impressed veins; there is a narrow groove along the raphal side and an intrusion of the integument deep and globular; the albumen is deeply ruminate; the embryo is placed in the centre of the side opposite to the intrusion of the integument.

HABITAT.—According to Miquel, this species was found growing near Tapos in Java. There are several places in Java having that name, but probably here it means Tapos in Bantam, as other plants collected by Junghuhn bear this locality. Nobody has as yet found this palm again in Java.

I have drawn the description of this species from specimens in flower and fruit, collected from plants cultivated at Buitenzorg, precisely under the name of *K. Junghuhnii.*

OBSERVATIONS.—In the vegetative organs *K. Junghuhnii* is so similar to *K. rigida*, that when not bearing flowers or fruits, it is nearly impossible to distinguish the one from the other. The inflorescence of *K. Junghuhnii* is however considerably smaller than that of *K. rigida* and has fewer and shorter branches and spikes. The flowers in *K. Junghuhnii* are somewhat larger than in *K. rigida*, and the corolla is relatively shorter; but the principal differences between the two are in the fruit; that of *K. Junghuhnii* being several times larger than that of *K. rigida*, of a quite different shape and with much larger scales. *K. Junghuhnii* resembles also in its leaves *K. debilis*, but in the latter the albumen is homogeneous.

The diagnostic characters of *K. Junghuhnii* are the slender stem; the leaves having 5—6 elongately cuneate-rhomboidal leaflets on each side of the rhachis; the ocreae 2—4 cm. long, having a short coriaceous base, and a fibrous and perishable upper part; the inflorescences composed of but few spike-bearing branches and these short, and bearing 3—4 spikes only; the spikes slender, of a glabrous appearance, having the spathels produced above the wool of the flower-bracteoles; the fruit globose or globose-turbinate, 16—18 by 14—15 mm., with the scales strongly convex, and with almost entire margins; the seed ruminate.

PLATE 79.—Korthalsia Junghuhnii *Miq.*—Portion of the stem and leaves from a full grown plant; a good portion of the spadix in flower; specimen from a plant cultivated at Buitenzorg (Herb. Beccari).

PLATE 80.—Korthalsia Junghuhnii *Miq.*—Portion of the stem with a leaf entire; the end of a fruiting plant with the spadix entire. Specimen from a plant cultivated at Buitenzorg (Herb. Beccari).

13. KORTHALSIA MERRILLII Becc. n. sp.

DESCRIPTION.—Very slender and not very high scandent (3—5 m. high—Merrill). *Sheathed stem* 8—10 mm. in diameter. *Leaf-sheaths* fugaciously scaly-furfuraceous, armed rather closely with scattered ascendent or spreading light-coloured, slender

spines, 4—6 mm. long. *Ocreae* tubular, closely sheathing, 4—5 cm. long, armed with the same kind of spines as the sheaths, membranous and truncate at their mouths, later disintegrated more or less into filaments. *Leaves* of the intermediate part of the adult plant 35—45 cm. long in the pinniferous part, bearing few (10 in all) alternate leaflets, and ending in a very slender, rather long, very minutely clawed cirrus. The leaves nearer to the inflorescence considerably smaller. Petiole very short. Rhachis irregularly and relatively powerfully clawed. *Leaflets* green on both surfaces, only slightly paler beneath, but devoid of any kind of pulverulent or crustaceous indumentum, very variable in size and shape; some are cuneate-rhomboidal and rather elongate in their lower part; others are exactly rhomboidal, about as long as broad; generally they have the anterior margins irregularly and not deeply toothed, some of the teeth being very acute and even subaristate; the apex is acute or acuminate, but not produced or caudiculate; the main nerves are 7—9, all slender; transverse veinlets not very sharp. Some of the largest leaflets measure 16—18 cm. by 7—8 cm., others 12—13 cm. by 8—10 cm.; the two lowest leaflets are the smallest in the few leaves examined; the ansae are strongly flattened and 5—10 mm. long. The leaves on the upper part of the flowering stem gradually diminish in length and have the leaflets smaller, broader, more exactly and symmetrically rhomboidal, and about as long as wide, measuring from 5 to 7 cm. equally in the two directions. The uppermost leaves, immediately below the inflorescence are, as usual, still more reduced. The *inflorescence* is small, composed of very few branches (two in the specimen seen by me), about 30 cm. long, bearing alternately 2 spikes on each side, and a terminal one. The *spathes* are tubular, unarmed, closely sheathing, brown, truncate and more or less split and lobed at their mouths, finely-striate, slightly and fugaciously puberulous-furfuraceous. *Spikes* inserted at the bottom of their respective spathes by means of a slender pedicellar part, itself provided with infundibular spathes; during the anthesis the spikes are flexuous, obtuse, 8—10 cm. long, and including the flowers 10—11 mm. in diameter; the flowers are half immersed in the dense fulvous wool with which their bracteoles are covered; the spathels are broadly triangular, blunt or subacute, often connate, thinly membranous, reddish-brown, striately-veined, not visible outside the wool of the bracteoles. *Flowers* small, 4 mm. long, 15 mm. broad, blunt; the calyx cyathiform-campanulate, broadly but not deeply 3-lobed, the lobes bluntish; its mouth remains on a level with the wool of the bracteoles, strongly striately-veined; the corolla is about twice as long as the calyx, and is divided nearly to the base into 3 oblong, striate segments; the stamens have very short filaments; anthers linear, elongate, acute; ovary small, globose; style conical, reaching about to the middle of the anthers; stigmas acute. *Fruit* unknown.

HABITAT.—The Philippines: Malampaya Bay in the Island of Palawan at sea level. Discovered by *E. D. Merrill* in May 1913 (No. 9410 in Herbaria of the Bureau of Science, Manila and Beccari).

OBSERVATIONS.—A slender species, in some respects related to *K. tenuissima*. It is, however, quite distinct among those provided with closely sheathing and spinous ocreae by its leaves having leaflets green on both surface, those of the leaves of the upper part of the plant being rhomboidal with symmetrical sides, and about

as long as wide, while those of the intermediate leaves are longer than broad; by the inflorescences being not much divided; but especially by the spikes having a very tomentose appearance from the flowers being half immersed in the wool of their bracteoles, and by the spathels not being produced above that wool.

Plate 81.—Korthalsia Merrillii, *Becc.*—The entire upper flowering end of a plant (in two parts), from the type specimen (No. 9410) in the Manila Herbarium.

Plate 82.—Korthalsia Merrillii, *Becc.*—Portion of the stem with an entire leaf from a young plant. From No. 9410 in the Manila Herbarium.

Latin Diagnosis.—Korthalsia Merrillii *Becc.* sp. nov.—Gracilis; vaginis spinis gracilibus armatis, ocrea elongata, arcte vaginanti et crebre spinosa, truncata membranacea, demum in fibris soluta; frondibus breviter petiolatis, segmentis rhombeis vel cuneato-rhombeis, utrinque viridibus, in margine anteriori argute dentatis dentibus nonnullis subaristatis; spadice parce ramoso, spicis conspicue tomentosis spathellis omnino in tomento immersis.

14. Korthalsia celebica Becc. n. sp.

Description.—Slender. *Sheathed stem* 12—15 mm. in diameter. *Leaf sheaths*, more or less disintegrated, especially in their upper part, into a fibrous net on the ventral side, and armed on that side only with two lines of short, subtuberculiform prickles. *Ocreæ* elongate (6—8 cm. long), closely sheathing, unarmed, coriaceous in their basal part on the side of the petiole, and disintegrated into a fibrous net in the remainder. *Leaves* having a very short petiolar part (2—4 cm. long), flat above, convex below, 4—6 mm. wide, provided at its axilla with a conspicuous callosity, and deep transverse rima; rhachis fugaciously rusty furfuraceous, armed irregularly with rather robust claws; the pinniferous part 35—55 cm. long; the cirrus irregularly clawed, the claws partly ternate, partly half whorled, and partly scattered. *Leaflets* not many, usually 5 on each side of the rhachis, oblong-cuneate or cuneately rhomboidal, longer than broad, acuminate, 15—20 cm long, 6—10 cm. wide, paler below than above (not mealy-white beneath), their upper margins undulate and obtusely lobulate toothed; the lowest and intermediate leaflets about the same size; the upper slightly smaller; ansae 10—15 mm. long, rusty-furfuraceous, thickish, apparently once fleshy. *Flowers* and *Fruit* unknown.

Habitat.—In Celebes at Kurosalimbo (*Noerkas* No. 483 in Buitenzorg and Beccari Herbaria, native name "Wwe Taimanu" (type specimen); and at Wadjo in the S.-W. Peninsula in the Gulf of Boni (*Heyne* No. 2586 in Buitenzorg and Beccari Herbaria. Aparently belong to *K. celebica* also *Koorders* No. 18398 B (Herb. Bogor. sterile) and another sterile specimen from Sula Mangoli, one of the group of Islands to the East of Celebes proper, at about 2° S. L. (*Hulstijn* No. 393 in Buitenzorg and Beccari Herbaria).

Observations.—Known only in a sterile condition. In general appearance it resembles the sterile specimens of *K. Merillii*, but it has the ocreæ unarmed, the lower leaflets of each leaf of about the same size as the intermediate, and the ansae thickish, and apparently fleshy on the living plant. It is also characterized by its very developed axillary callosities and the obtusely undulate-toothed margins of the leaflets.

LATIN DIAGNOSIS.—Korthalsia celebica *Becc.* sp. nov. Gracilis, vaginis in ventre sphacelato-fibrosis et in dorso spinis tuberculiformibus armatis, ocrea elongata, arcte vaginanti, inermi, in parte basilari coriacea, superne reticulato-fibrosa; frondibus brevissime petiolatis; petiolo callo axillari conspicuo prædito; segmentis ansa crassiusacula suffultis, cuneato-rhombeis, basilaribus et intermediis subæqualibus, utrinque virentibus, subtus vix pallidioribus, in margine anteriori obtuse undulato-dentatis.

15. KORTHALSIA ROGERSII Becc. n. sp.

DESCRIPTION.—Very slender. *Sheathed stem*, 6 mm. in diameter. *Leaf-sheaths* glabrous, finely-striate, quite unarmed. *Leaves* of the upper part of the fertile plant (the only ones present) very small, 25—30 cm. long, including a slender finely clawed cirrus, and having 4 leaflets on each side of the rhachis. *Ocreæ* elongate, cylindrical very closely sheathing (3 cm. long in one specimen), thinly membranous and fibrous; petiole very short, broadly channelled above, convex beneath. Rhachis very sparingly and minutely clawed. *Leaflets* small, 4·5—6 cm. long, 2·5—4 cm. broad, broadly cuneate-rhomboid with the apex acute or caudiculate, rigid-papyraceous, glabrous and green on the lower surface or else slightly paler than on the upper; the margins, from about the middle or from a little above it, are rather sharply erosely toothed, have 6—7 very fine but acute main nerves; ansae strongly flattened, 4—5 mm. long. *Inflorescence* apparently formed only by a few spreading branches, 15 cm. long. (in one specimen) each bearing very short branchlets with 1—3 spikes only; primary spathes unarmed, tubular in their lower part, produced above into an ovate acute limb; the spathes of the branchlets tubular-infundibuliform, almost truncate at their mouths. *Spikes* small 3 cm. long (always ?), 5 mm. broad (without the flowers), of a very tomentose appearance, the spathels being entirely concealed by the dense wool of the flower-bracteoles. *Fruit* obovate-turbinate, a little attenuate towards the base, roundish or slightly flattened above, very minutely mucronate, 18 mm. long, 15 mm. broad; scales not strongly convex, grooved along the centre, straw-yellowish in colour, having the apices flattened and of a reddish-brown colour, rather appressed, bluntish or rounded, and the margins conspicuously ciliate-fringed.

HABITAT.—Collected in the Andamans by *C. G. Rogers* (22. III. 1904, No. 143 Herb. Hort. Calc. in Herb. Becc.).

OBSERVATIONS.—I have seen only the terminal part of this plant bearing two leaves, a portion of the inflorescence, and one fruit.

This apparently distinct species is mentioned by Brandis under *K. laciniosa* Mart. (Indian Trees, p. 719) (Addenda).

If it is not a dwarf form of *K. laciniosa*, it certainly represents one of the smallest species of the genus, having the dimensions of *K. tenuissima*.

It is characterized by its very slender stem, by the small leaves having rhomboidal subconcolorous leaflets, by its elongate closely sheathing ocreae, by the small tomentose spikes, and by the relatively large globose fruit.

PLATE 83.—(Lower figure) Korthalsia Rogersii *Becc.*—The entire type specimen in Herb. Beccari.

LATIN DIAGNOSIS.—Korthalsia Rogersii *Becc.* sp. nov. Gracilis; vaginis inermibus, ocrea cylindrica elongata, arcte vaginanti, tenuiter membranacea et fibrosa; frondibus superioribus parsis, brevissime petiolatis, segmentis paucis cuneato-rhombeis, concoloribus vel subtus vix pallidioribus; inflorescentiis parce ramosis, spicis parvis, tomentosis; fructibus obovato-turbinatis, pro rata majusculis, squamis in margine conspicue ciliato-fimbriatis.

16. KORTHALSIA TENUISSIMA. Becc. Malesia, ii, 275; Hook f. Fl. Brit. Ind. vi, 476; Ridley, Mat. Fl. Mal. Penins. ii, 218.

DESCRIPTION.—A very slender palm, up to 30 m, long. *Sheathed stem* 4—5 mm. in diameter, the naked canes only 3 mm. in diameter. *Leaf-sheaths* glabrous, finely striate, armed with a few short scattered claws. *Leaves* very small, those of the upper part of the flowering plant are only 20—30 cm. long, including a slender finely-clawed cirrus, and on the whole have only 4—6 leaflets. *Ocreæ* cylindrical, very closely sheathing, glabrous and unarmed, 15—20 mm. long, membranous, perishable in their upper part. Petiole short, and furnished, at its axilla, with a conspicuous and swollen cushion. The *leaflets* are alternate, rigid-papyraceous, cuneately rhomboidal, have the apex acute and somewhat caudiculate, and the upper margin, from above the middle, undulately and obsoletely toothed; are conspicuously discolorous, being deep green above, and covered on the lower surface with a thin chalky coating; the main nerves are about 7 but very faint, and only the central one rather sharp; the largest leaflets are 10—12 mm. long, 3—4 cm. broad; those of the uppermost leaves are considerably smaller; the ansae appear to have been rather fleshy and 3—6 mm. long. *Inflorescence* formed of a very few terminal, erect spikes (2—3 in the few specimens seen by me). Spathes smooth, sheathing in their lower part, expanded above into a broad ass's ear-like, acuminate limb. *Spikes* 8—10 cm. long and 12—13 mm. in diameter with the flowers, and only 6 mm. without; in this latter condition they have a slightly tomentose appearance; spathels concave, roundish, striately-veined, slightly produced beyond the wool of the flower bracteoles, the two external of which are amplectent, and form a deep cup, crested with a cushion of short, thick, woolly hairs for their respective flowers. The *flowers* are disposed on the spikes in about 12 longitudinal series, and protrude considerably beyond the involucra, above which the mouth of the calyx is visible; the fully developed flower buds are terete, oblong, obtuse, 6 mm. long, 2—5 mm. broad; the calyx is campanulate, obsoletely 3-toothed, striately-veined; the corolla is twice, or even a little more, as long as the calyx; its segments oblong and finely striately veined, are very shortly united by their bases; the stamens have very short and thick filaments, very shortly united to the corolla by their bases; the anthers are linear, bluntish or acute; the ovary is small, surmounted by a thick columnar style, trigonous and longitudinally sulcate, always a little shorter than the stamens; stigmas punctiform. *Fruit* unknown.

HABITAT.—The Malay Peninsula at Larut in Perak, in low swampy grounds in dense forests (*King's Collector* No. 4657 in the Calcutta Herbarium).

OBSERVATIONS.—A very slender species, distinguishable by its very small leaves, having very few rhomboidal leaflets, chalky white beneath, by its entire, very closely

sheathing and unarmed ocreæ, and by its inflorescence, composed of only a few spikes of a not very tomentose aspect and bearing relatively large flowers.

PLATE 84.—Korthalsia tenuissima *Becc.*—The entire type specimen in the Herbarium at Calcutta.

17. KORTHALSIA LACINIOSA Mart. Hist. Nat. Palm. iii, 211, 343; Miq. Fl. Ind. Bat. iii, 77 (*K. laciniata*); Kurz, Burm. Palms in Journ. As. Soc., Beng. xliii (1874), 207 (excl. syn.): For. Fl. Brit. Burma, ii, 513; Becc. Malesia, ii, 74 (excl. pl. Selangore) and in Bull. Mus. Hist. Nat., Paris (1911), 158; Hook. f. Fl. Brit. Ind. vi, 479; Gamble Man. Ind. Timb., 2d. edit., 737; Brandis, Ind. Trees, 654, 719.

K. laciniosa Mart. ? Becc in Webbia di U. Mart. iii, (1910) 244.

Calamosagus laciniosus Griff. in Calc. Journ. Nat. Hist. v, 23, t. 1; Palms Brit. Ind. 27, t. CLXXXIII and CCXVI, f. 2.

K. andamanensis Becc. Malesia, ii, 76.

K. scaphigera (non Mart.) Kurz in Journ. As. Soc. Beng. l. c. 207 (excl. syn.) t. XX f. A: Forest Fl. l. c.

DESCRIPTION.—A large species. *Sheathed stem* 2—3 cm. in diameter. *Leaf-sheaths* distintegrating along the ventral side into embracing fibres, otherwise very thick and woody, quite smooth or at times more or less armed, especially at the base of the petioles and along the dorsum, with very short straight horizontal or slightly deflexed scattered spines having a very thick base. The *ocreæ* are elongate, 10—15 cm. long, and prolonged above into a liguliform limb, are unarmed, or furnished at most with only a few spinules, are originally dry and thinly membranous, but very soon become entirely ragged and disintegrated into filaments, especially on the ventral side, so much so that in old leaves the ocreæ may appear to be wanting. *Leaves* large, those of young plants terminating in a fiabellate leaflet; those of half grown plants have a slender cirrus, and a rather elongate 20—25 cm. petiole, whereas those of the full grown and fertile plants have the petiole short, the pinniferous part about 1·5 m. long, ending in a very powerfully-clawed cirrus about as long, and bearing about 10 leaflets on each side of the rhachis. The petioles in no case have any distinct callosities at their axillas, are broadly channelled above, convex and unarmed below, and are more less irregularly beset on their margins, especially in their basal part, with straight spines, the largest of which are 10—12 mm. long. The rhachis is armed at the sides below (but not along the centre) with single robust claws; in some leaves, apparently belonging to young plants, the petiole is quite unarmed. The *leaflets* are very variable in shape and size, from considerably longer than broad or cuneate-oblong or obovoid-cuneate to broadly rhomboidal or trapezoidal and about as long as broad; they are green above and more or less glaucous and in newly expanded leaves are distinctly mealy-white beneath; they are rigidly-papyraceous, have 11—15 equally strong main, radiating nerves, ending in as many double-toothed, sharp, subulate points, the

point of the centre, the true apex, being longer than the others ; transverse veinlets much interrupted, and not very prominent. The largest leaflets are 20—30 and at times as much as 40 cm. long, and 15—20 cm. broad ; those of the lower part of every leaf are usually as long, but narrower than those above ; the largest and broadest are those of the middle. The ansæ are very conspicuous, very strongly flattened, and almost laminar, 15—20 mm. up to 3 cm. long, and 4 mm. broad, glabrous or nearly so. *Inflorescence* large, divided into several secondary or tertiary spike-bearing branches 20—30 cm. long ; spathes tubular-infundibuliform, truncate or produced above into a short triangular limb, usually smooth, at times slightly prickly, at first entire, but at the fruiting stage more or less split. The *spikes* are alternate, 3—5 on each branch, have a conspicuous tomentose appearance, the tip only of the spathels being visible outside the dense wool of the flower bracteoles ; are usually 8—10 cm. long, at times shorter, and 13—14 mm. broad, and 7 mm. without the flowers ; spathels very broad, strongly striately-veined connate by their margins, almost entirely immersed in the wool of the bracteoles and having only their small traingular apex very shortly produced beyond the wool which is very copious in the two principal floral bracteoles. *Flowers* arranged in 12 longitudinal series ; the full grown buds are oblong, obtuse, very obsoletly trigonous or subterete, 6 mm. long, 2·5 mm. broad ; the calyx is cyathiform, attenuate to the base, striately veined, divided down to about the middle into 3 very broad acute teeth ; its mouth remains at a level with the wool of the bracteoles ; the corolla is three times, or nearly so, as long as the calyx, deeply divided into 3 cartilaginous cymbiform acute segments, finely-striate outside ; the stamens have thick and short triangular filaments, united to the short undivided basal part of the corolla ; anthers long-sagittate, acute ; ovary ovoid, narrowing above to a conical sulcate acute style, reaching the bases of the anthers. The *fruit* is obovoid, and is attenuate a little at the base, is rounded above and surmounted by a small pungent, 1·5 mm. long beak, is 16-17 mm. long (including the beak) and 11 mm. broad ; the scales are arranged in 15 longitudinal series, subsquarrose, or having the apices not very appressed, are slightly convex, faintly and broadly grooved along the centre, of a cinnamon brown colour in their posticous part, thinner, and of a lighter colour anticously, and marked with a darker intramarginal line near the apices, the margins conspicuously ciliate-fringed. *Seed* globular-ovoid, 10—11 mm. long, 8 mm. broad, equally rounded at both ends, the surface slightly uneven or rimulose or very obsoletely tubercled ; the intrusion of the integument is very large ; albumen ruminate.

HABITAT.—Tenasserim, Andamans and Nicobars, Sumatra, Indo-China (?). Griffith established this species on specimens collected in woods along the sea-shores of the Islands of the Mergui Archipelago. These specimens exactly correspond with some (sterile) collected by *Brandis* at Salween in N. Tenasserim. It seems a rather common plant in the Andamans, and in the Nicobars. From the Andamans I have seen the specimens referred by Kurz to *K. scaphigera* (my description of the fruit is derived from these). In the South Andamans specimens were gathered by *Didrichsen* at Sambalong (Galathea-Expedit, 1845-47—Herb. Haun.) ; on the Putatan stream by *Prain's Collector* (No. 58 in Herb. Calc. and Becc. and No. 49 without precise locality) ; in the Jarawakhari Jungle by *King's Collector* (No. 110

in Calcutta Herbarium). Large sterile specimens from the Andamans were sent to me in 1889 by Mr. *E. H. Man* under the native name of "Por." In Sumatra it was encountered recently (1915) by *M. Grasshoff* at Lematang ulu in the Residency of Palembang (specimens with fruits in the Herbaria of Buitenzorg and Beccari). From the Nicobars I have seen a specimen (one leaflet only) from the Great Nicobar at Ganges Harbour (*Rogers* in Calcutta Herbarium) and a portion of the spadix in flower from Car Nicobar (*King's Collector*—Calcutta Herbarium—the flowers described above are from this specimen). Also from the Nicobars Mr. *Man* sent me in 1888 large fruiting specimens under the native name of "Shamoa." To this Palm Gamble gives the Andamanese names of "Bordah" and "Parida."

It seems to me that some sterile specimens collected by *Pierre* in Cambodia (No. 4860 on Mt. Keerev, Prov. Samrong-ton; No. 1878 at Songlu, Prov. Bien-hoa, and No. 1877 at Bow-Chiang in Cochin China; all in the Herbarium at Paris) may be considered as not specifically distinct from the plant of the Andamans and the Nicobars.

A note of Pierre to his No. 4860 states this palm to be a very high scandent plant, with stem 3—4 cm. in diameter, and to No. 1878 he attributes the names of 'May-ra" in the Annamite, and "Re-ngan" in the Moi languages.

Observations.—This is one of the largest species of the genus, distinguishable by its leaf sheaths distintegrating into a fibrous net along the ventral side, and not, or only very sparingly, spinous, and prolonged into a very elongate not inflated ocrea of a thin membranous perishable nature; by the large leaves having numerous oblong-cuneate or cuneate-rhomboidal or exactly rhomboidal or trapezoidal leaflets, at first mealy-white, but finally simply glavcescent beneath, presenting 11—15 main nerves, which end in as many sharply double-toothed and subulate points; by the large paniculate much branched inflorescences; by the spikes of a very densely wooly appearance when without flowers, having their spathels projecting very briefly beyond the wool; by the fruit obovoid, but suddenly beaked, having subsquarrose scales, slightly convex, not deeply grooved, and densely ciliate-fringed at the margins, and by the ruminate albumen of the seed.

It is very variable in size, shape and colour of the leaflets, according to the age of the plant and the position the leaves occupy on the stem. The leaf-sheaths also vary in their armature. Man's specimens received under the name of "Por" have quite smooth leaf sheaths, covered with a light coloured, fugacious, powdery efflorescense. The other specimens from the Nicobars, also collected by Man, but sent under the native name "Shamoa" have the powdery efflorescence on the leaf-sheaths of a dark colour, and are rather powerfully armed along the dorsum with rather robust, broad spines, having sharp edges, and very short points. These specimens somewhat differ from those I have seen from the Andamans, in having more roundish fruits with darker scales, a difference probably dependent on age, their fruits not being perfectly mature. I have, however, found the flowers of the specimens from the Nicobars to be quite identical with those of the Andamans. Kurz writes that in the Andamans occurs another species of the habit of *K. laciniosa*, but with

the sheaths densely covered with sharp spines; probably, however, that spinescence is only an occasional, not a specific character.

Grasshoff's Sumatran specimens exactly agree with those from the Andamans.

PLATE 83.—(In the upper part of the plate) Korthalsia laciniosa *Mart.* Small, portion, near the end, of a leaf from the upper part of a fertile plant; branch of the panicle bearing spikes with flowers. Specimen from the S. Andamans, Prain's Collector No. 58 in Herb. Beccari.

PLATE 85.—Korthalsia laciniosa *Mart.*—Portion of the spadix with not quite mature fruits; portion of the sheathed stem, and base of a leaf, from a not full grown plant (the leaf was terminated by a slender cirrus); intermediate portion of a leaf (which was terminated by a robust cirrus) belonging to an adult plant. From Man's specimens from the Nicobars, with the native name "Shamoa" (Herb. Beccari).

PLATE 86.—Korthalsia laciniosa *Mart.*—Portion of the sheathed stem and intermediate portion of a leaf from a not full grown plant. (The leaf had a not very robust cirrus.) From Man's specimens from the Andamans, with the native name "Por" (Herb. Beccari).

18. KORTHALSIA TEYSMANNII Miq. in Journn. Bot. Neerl., i, 16; Prod Fl. Sum. 255, 591; De Palm. Arc. Ind. 17, 26; Becc. Malesia, ii, 76. *K. robusta* Bl. Rumphia, ii, 70 (as to the leaves only and partly). *K. grandis* Ridley, Mat. Fl. Mal. Penins. ii, 217;

DESCRIPTION.—The largest of all known. *Sheathed stem* 2—3 cm. in diameter and at its upper and flowering end apparently considerably more. *Leaf sheaths* more or less spinous, thick and woody on the dorsum, of a thinner structure and often split and lacerated on the ventral side. *Ocreæ* closely sheathing, 8—10 up to 15 18 cm. long, partially covered with a removable tobacco-coloured fugacious scurf, thinly coriaceous or papyraceous, truncate above, finally more or less ragged or disintegrated into fibres, armed with some scattered, broad, laminar, straight spreading spines. The *intermediate leaves* of the adult plants have a petiole 10—20 cm. long, 10—12 mm. broad, spinous on the margins, and not having a distinct callus at its axilla; the pinniferous part is about 1·30—1·50 m. long, bears 8—9 leaflets on each side, and ends in a long robust clawed cirrus. The rhachis is armed below at the sides but not along the centre, with single robust claws. The *leaflets* are at first mealy, whitish beneath, and finally only slightly paler than above; those of the lower part of every leaf are oblong-cuneate, 25—30 cm. long, and only 7—8 cm. broad, and at times even less; the intermediate leaflets are larger and broader, cuneate-rhomboidal or trapezoidal, 30—35 cm. long, 13—16 cm. broad, have 11—15 main nerves, which end in as many double-toothed subulate points; the transverse veinlets are much interrupted and not particularly prominent. The leaves nearer to the base of the inflorescence are much reduced in length, have a very short petiole, and the rhachis closely clawed; their leaflets are considerably smaller than in the lower leaves, oblong-cuneate or rhomboidal-cuneate; distinctly plicato-pluricostulate, 8—12 cm. long, 3—6 cm. broad; the uppermost leaves are still more reduced, and have still narrower leaflets. *Inflorescence* large, up to 1·50 m. long, composed of

several secondary branches, 20—40 cm. long; spathes tubular-infundibuliform, produced above to a triangular acute limb, usually smooth or, in the lower part of the panicle, slightly prickly. *Spikes* horizontally spreading from a robust pedicellar part, alternate, 3—4 on each branch, relatively large, of a conspicuous tomentose appearance, 11—12 cm. long, and when without the flowers, 10 mm. in diameter throughout immediately from the base; the spathels are low, reniform, considerably broader than high, not or very obsoletely apiculate, united by their margins, and almost invisible outside, being hidden by the very abundant wool of the flower-bracteoles. *Flowers* . . . . In the *fruiting perianth* the calyx only remains and is split down to the base into 3, broadly ovate, acute, finely-striate segments. *Fruit* obovate-turbinate, flattish above, but having a short conical beak in the centre; it is gradually attenuate at the base, 20—24 mm. long, 17—18 mm. broad; scales in 16—17 longitudinal series, with the apices not very appressed or sub-squarrose; the largest scales are 5 mm. broad, slightly convex, broadly channelled along the centre, of a yellow straw colour in the posticous part, produced anticously into a thin, triangular, membranous, reddish-brown apex, and conspicuously laciniate-ciliate on the margins. *Seed* obovoid, rounded at both ends, 14—15 mm. long, 11 mm. broad, the surface slightly uneven, rimulose or very obsoletely tubercled, grooved along the lower half on the raphal side; intrusion of the integument very large; albumen deeply ruminate; embryo placed a little below the middle on the antiraphal side.

HABITAT.—Originally described by Miquel from specimens gathered by *Teysmann* in the interior of East Sumatra at Muara dua in the Province of Palembang; native name "Tengkurungo." Found there again by *Grashoff* (No. 425 Buitenzorg and Beccari Herbaria). It was cultivated several years ago in the Botanical Garden at Buitenzorg, whence the late Dr. Treub forwarded to me in 1885 good fruiting specimens (those described above) under the name of *K. robusta* Bl. Recently sterile specimens, which, however, I consider confidently as referable to *K. Teysmannii*, were collected again in Sumatra in Lampong by *Heyne* No. 317 in Buitenzorg Herbarium. A *Korthalsia* growing in Java on the volcano Salak, of which specimens from sterile plants were sent to me from the Buitenzorg Herbarium (*Heyne* Nos. 9, 40, 42, 53) and others collected by *Koorders* (No. 34580β) on Gunong Djanti, near Palabruanratu Residency of Preanger are also, I think, referable to *K. Teysmannii*.

If *K. grandis* Ridley is, as I presume, the same as *K. Teysmannii* the geographical distribution of the latter would be extended to Singapore. (See *K. grandis* Ridley among the imperfectly known species.)

OBSERVATIONS.—It is perhaps the largest species of the genus; very closely related to *K. laciniosa*, from which it is barely distinguishable when in a sterile condition. In *K. Teysmannii*, however, the ocreæ are of a more rigid texture, and less worn-out by age and more spinous than in *K. laciniosa*; but the main differences lie in the fruit, that of *K. Teysmannii* being considerably larger than that of *K. laciniosa*, more distinctly turbinate, clothed with larger scales, which also are prolonged into a membranous conspicuously ciliate triangular apex.

From the description given by Miquel it would have been impossible to recognise this species, which was based upon very incomplete specimens, consisting only of the terminal part of the flowering plant. Of these specimens (No. 3593 Herb. Bog.), however, I received from the Utrecht Herbarium a fragment, which has rendered the identification of the plant described by Miquel, with that cultivated at Buitenzorg, and described above by me, quite certain.

Plate 88.—Korthalsia Teysmannii *Miq.*—Upper end of a fruiting plant; one of the leaves immediately below the inflorescence; a segment of the intermediate part of a leaf from a full grown plant; portion of the fruiting spadix. From the specimens sent to me by Treub under the name of *K. robusta*, Bl. (Herb. Beccari).

Plate 88.—Korthalsia Teysmannii *Miq.*—(*K. grandis*. Ridley). Upper part of a leaf-sheath with its ocrea, and base of a leaf, and an intermediate portion of it; from Ridley's co-ttype specimens of *K. grandis* in Herb. Beccari.

19. Korthalsia ferox Becc. Malesia, ii. 73.

Description.—One of the largest, but the first description of this species was derived from specimens apparently belonging to not fully grown plants (P. B. No. 1913), which have the *stem* when covered with the leaf-sheaths 10—20 cm. in diameter. The *leaf-sheaths* are finely and fugaciously rusty furfuraceous, thin and more or less disintegrated into fibres on the ventral side, and rather powerfully armed all round with straight, broad-based, rather short (5—12 mm. long) spreading spines, solitary or often more or less confluent by their bases. The *ocreæ*, in the above-mentioned specimens, are 4—9 cm. long, closely sheathing and also rather thickly armed with spines similar to those of the sheaths, coriaceous in their lower part, but membranous and ragged or more or less disintegrated into a fibrous network above, and along the ventral (external) side. The *leaves* are large and bear several cuneate-rhomboidal *leaflets*, 11—25 cm. long, 6—9 cm. broad, glaucescent beneath, and provided with flattened ansæ. In one specimen, which I consider as representing the adult and fertile stage of this palm taken from a plant cultivated at Buitenzorg (introduced from Borneo) the *sheathed stem* is about 4 cm. in diameter; the *leaf-sheaths* are armed on the ventral side only with strong, flattened, broad-based spines, 10—15 mm. long, and usually obliquely inserted; the ocrea is about 10 cm. long, dry and perishable, especially on the external side, armed with spines exactly like those of the sheaths or even larger, some being 2 cm. long and 10 mm. broad at their bases, and also obliquely inserted. The *leaves* are very large; the petiole (in one specimen) is flattish above, convex beneath, 20 cm. long, 15 mm. broad and has no distinct callus at its axilla; the pinniferous part is 1·50 m. long, bears several leaflets on each side, and ends in a long and robust clawed cirrus. The *leaflets* are rigid-papyraceous, almost equally green on both surfaces or slightly paler beneath than above, cuneate-rhomboidal; generally the intermediate leaflets of every leaf are larger than those of both ends, have 11—13 equally strong main nerves, ending in as many double-toothed sharp, subulate points, of which the central is longer than the others; the largest (intermediate) leaflets are 30—35 cm. long, 12—15 cm. broad; the basilar are about 30 cm. long, and 6—9 cm. broad;

the uppermost 20—25 cm. long by 8—10 broad; the ansæ are very strongly flattened or laminar and very long (3·3—5 cm.). The *spadix* (only fragments seen by me) is very much like that of *K. Teysmannii*; the *spikes*, borne on a rather long pedicellar part, are exserted from their respective spathes, are 10—11 cm. long, 10 mm. broad and have a conspicuous tomentose appearance, their spathels being entirely hidden in the dense wool of the flower-bracteoles. *Fruit* oblong-turbinate or broadly clavate-turbinate, gradually attenuate from near the apex towards the base, with the apex rounded and surmounted by a short conical pungent mucro, 2 cm. long, and 10—11 cm. broad; the scales are in 15 longitudinal series, regularly rhomboidal, the largest 5 mm. long and as many broad, convex, deeply grooved along the centre, glossy, uniformly reddish-brown, with a very narrow dark intra-marginal line; the apices appressed, not prolonged, obtuse; the margins bordered with a narrow fringe of rusty cilia. *Seed* oblong or oblong-elliptical, 13—14 mm. long, 7·5—8·5 mm. broad, and a little less in thickness, being slightly flattened blunt at both ends; its surface is covered by a network of faintly impressed veins and is grooved (not deeply) along the raphal side; the intrusion of the integument is large and oblong; the albumen is ruminate; the embryo is in the middle of the antiraphal side.

HABITAT.—Borneo. The description of *K. ferox* was based on sterile specimen collected by me on Mt. Mattang near Kuching, in Sarawak (P. B. Nos. 1913, 1926); native name "Rotang Dahan" or the "Branched Rotang," a name applied by the Malays to all *Korthalsias* having a large terminal inflorescence.

Specimens corresponding to the preceding, but having the leaf-sheaths and the ocreæ still more densely spinous were collected by *Heyne* (No. 2523 Buitenzorg and Beccari Herbaria) at Pontianak, in Dutch Borneo. All the above-mentioned specimens are evidently from plants that had not attained their full development. One from the Sungei Kenepai collected by *Hallier* (No. 2018 in Buitenzorg Herbarium) apparently belonging to a more adult plant than the preceding, but exactly corresponding to them in general aspect, has the sheathed stem 20—22 cm. in diameter, but the leaflets are larger, some of them being 28 cm. long and 12—13 cm. broad. This specimen makes the transition to the plantbearing fruit, upon which I have mainly based the description of the adult plant, and which was gathered from a plant cultivated at Buitenzorg, but of Bornean origin.

OBSERVATIONS.—*K. ferox* is very closely related to *K. Teysmannii* and *K. laciniosa*; indeed the specimens of these three species are with difficulty, if at all, distinguishable the one from the other, when not in fruit.

K. ferox is characterized by its large size; by the ocreæ covered with broad, flattened spines; by the large leaves bearing numerous cuneate-rhomboidal leaflets, having the upper margins terminated by very acuminate teeth; by the spikes tomentose and having the spathels entirely immersed in the wool of the flower-bracteoles; but especially by the oblong-clavate fruit, considerably narrowing at the base, and having convex deeply grooved scales, with narrowly and minutely fringed, ciliate margins, and obtuse, appressed apices; and finally by the oblong, ruminate seed.

PLATE 89.—Korthalsia ferox *Becc.*—The type specimen P. B. No. 1926 in Herb. Beccari.

PLATE 90.—Korthalsia ferox *Becc.*—Leaf-sheath with its ocrea and the base of the petiole; upper end of a leaf from a full grown plant; portion of the fruiting spadix. From a plant cultivated at Buitenzorg (No. 385 Herb. Bogor. in Herb. Beccari).

19*a*. KORTHALSIA FEROX var. MALAYANA Becc. in Hook. f. Fl. Brit. Ind. vi 476; Ridley, Mat. Fl. Mal. Penins. ii, 218.

DESCRIPTION.—Smaller than the type. *Sheathed stem* of the flowering plant 15 mm. in diameter. The *leaf sheaths* and the very short truncate *ocreæ* are armed with very short spines on the ventral face; petiole and rhachis fugaciously furfuraceous. *Leaflets* few, rhomboidal, or in younger plants cuneate-rhomboidal, 12—20 cm. long, 6—10 cm. wide, greenish beneath, rather obtusely and boldly undulately double-toothed on the upper margin; the teeth very shortly apiculate (not aristate); the ansæ somewhat flattened, thickish at the base. *Inflorescence* small, apparently about 60 cm. long, composed of a few short primary branches, each bearing a very few spikes. The *spikes* have a pedicellar part more or less exserted from their respective spathes, are 8—10 cm. long, 10—11 mm. in diameter with and 6 mm. without the flowers and have not a very tomentose appearance, the calices of the flowers being half exserted from the woolly bracteoles. *Flowers* 4·5 mm. long.

HABITAT.—The Malay Peninsula at Larut in dense jungle on the Hills (*King's Collector* No. 6563 in Herb. Calc. The type specimen with flowers.) Sterile specimens have also been collected in the same region by *Scortechini*, one bearing the date September 1884 on Gunong Ijuk.

OBSERVATIONS.—I have considered this as a variety of *K. ferox*, but it could also be supposed to be a distinct species or a form of *K. laciniosa*, from which, however, differs in its smaller dimension; in the short, slightly spinous ocreæ; by the leaflets being only obtusely toothed, and the smaller spikes less distinctly tomentose and having smaller flowers, with their calices conspicuously protruding beyond the villous bracteoles. In the type specimens one leaf from the upper part of the plant has a very short petiole and the pinniferous part is 30 cm. long, and has in all 9 segments exactly rhomboidal. In one of Scortechini's specimens, that from Gunong Ijuk, the leaves are exactly of the dimensions of the type, but the leaf-sheaths are armed on their lower part and on the dorsal face with rather robust short conical prickles and with small spines above on the ventral face, as well as on the short (1 cm. long) truncate ocreæ. One leaf has the petiole 20 cm. long, the pinniferous part 45 cm. long and bearing 10 cuneately-rhomboidal leaflets. Other specimens also collected by Scortechini, belonging to younger plants, have smooth leaf-sheaths, ocreæ coriaceous in their basal part and terminated by a perishable fibrious-net and leaves of the dimensions of the other specimens. Probably when the fruit of this variety shall be known, it may prove to be a distinct species.

PLATE 91.—Korthalsia ferox *var.* malayana *Becc.*—The entire typical specimen in the Calcutta Herbarium.

20. KORTHALSIA WALLICHIÆFOLIA H. Wendl. in Kerchove, Palms, 248; Becc. Malesia, ii, 75; Hook. f. Fl. Brit. Ind. vi. 475; Ridley Mat. Fl. Mal. Penins. ii, 217.

Calamosagus Wallichiæfolius Griff. in Calc. Journ. Nat. Hist. v, 25.

C. Harinæfolius Griff. Palms Brit. Ind. 29, t. CLXXXIV.

DESCRIPTION.—Large and high scandent. *Sheathed stem* 2—3·5 cm. in diameter. *Leaf-sheaths* thick and woody, more or less split along and disintegrated into a fibrous net on the ventral side, very sparingly armed with short conical prickles or almost smooth; the surface is dull, and very slightly rough to the touch. *Ocreæ* of old leaves closely sheathing, truncate, short (1—2 cm. long), more or less disintegrated into fibres on the ventral side, unarmed or nearly so, apparently produced into a perishable membranous and fibrous limb in young leaves. The *leaves* of the adult plant are large, have numerous leaflets, and end in a long robust cirrus; the petiole is flattened, flattish above, has very obtuse edges, is convex and armed with few robust claws beneath, and is furnished with a conspicuous callus at its axilla; the rhachis is armed below with robust claws, at first single, then binate-higher up tri-nate, and in the cirrus 5-nate or half-whorled. The *leaflets* are at first whitish beneath and finally slightly glaucous or only somewhat paler than above; those of the lower part of every leaf are cuneate-rhomboidal, about 30 cm. long, 10 cm. broad; the intermediate are broader, rhomboidal or trapezoidal, 20—25 cm. long, 18—20 cm. wide, have 9—11 main nerves, which end in as many obsoletely double-toothed, not produced, broad, bluntish points. The *ansæ* are elongate, 10—20 and at times up to 30 mm. long, thickish and wrinkled, and therefore in the living plant probably somewhat fleshy and subterete, very minutely rusty-furfuraceous; the same kind of minute scurf covers the petiole and the rhachis in newly expanded leaves, but is more or less deciduous afterwards, and the surface of those organs remains very minutely scabrid. The inflorescence, according to the plate given by Griffith, is large, the flower-bearing branches are short, and bear only 2—3 spikes; the latter are 20 cm. long and 1 cm. broad, tomentose, but with the spathels very clearly visible or even considerably produced beyond the wool of the flower-bracteoles. *Fruit* . . . . .

HABITAT.—The Malay Peninsula and probably also Sumatra. Griffith described this species from specimens brought to him from a place called Kussan (or Kesang?) near Malacca. Ridley says that it is common in Singapore at Bukit Timah (No. 10407 in Herb. Becc.) and in Johore at Kwala Sembrong (*Ridley*). To this species belongs, I think, a specimen collected in Selangor by *Franz Keheding* in 1878 (Herb. Becc.). This specimen in "Malesia" II, 74 was considered to be *K. laciniosa.*

Apparently also referable to *K. Wallichiæfolia* is *Heyne's* No. 311 of the Buitenzorg Herbarium, collected in Lampong (S.-E. Sumatra), represented by a specimen from a young plant, the leaves of which have the petiole with a large

axillary callus, obtusely toothed leaflets, and thickish rusty-furfuraceous wrinkled ansæ.

Ridley writes of *K. Wallichiæfolia* that, although a common plant in Singapore, he never succeeded in finding flowering specimens. Probably this Rattan is much sought after by the natives, and is gathered before the plant has attained its complete development.

OBSERVATIONS.—It is one of the largest, but a very imperfectly known species, very similar to *K. laciniosa*, but as noted by Griffith, distinguishable by the obtuseness of the teeth of the leaflets, and I may add, by the thick callus and transverse rima occurring in the axilla of the petioles, and by the thickish rimulose ansæ of the leaflets, which in the living plant apparently must be somewhat fleshy and subterete and not strongly flattened as those of *K. laciniosa*.

The same peculiarities differentiate *K. Wallichiæfolia*, from *K. Teysmannii* and *K. ferox*.

According to the description and plate given by Griffith, *K. Wallichiæfolia* differs from *K. laciniosa* and *K. Teysmannii* also in the spikes having the spathels produced beyond the wool of the flower-bracteoles, instead of being almost entirely hidden by the tomentum. Griffith gives for his *Calamosagus Wallichiæfolius*, the Malay name of "Retang Simote" (Sumut or the "the Rotang of the Ants." (This name, however, is strictly speaking given to the *Korthalsias* which harbour ants in their inflated ocreæ; but possibly ants are clients of this Palm also, on account of the calluses existing in the axillas of the petioles, and apparently also of the ansæ which probably have the function of extra-floral nectaries.

PLATE 92.—Korthalsia Wallichiæfolia *Wendl.*—Intermediate portion of the sheathed stem and base of a leaf (note the callosity at its axilla); upper portion of a leaf from an adult plant. From Ridley's specimen No. 10407 in Herb. Beccari.

21. KORTHALSIA HALLIERIANA Becc. n. sp.

DESCRIPTION.—*Sheathed stem* 14—16 mm. in diameter, with long internodes. *Leaf-sheaths* not gibbous above, gradually passing into the petiole, almost smooth, presenting only a few short spines along two lines on the ventral face. *Ocreæ* short, truncate, perishable, closely sheathing, unarmed. *Leaves* rather large; petiole 25—28 cm. long, 6 mm. broad, and having a conspicuous axillary callus, flat above, convex and armed with a few solitary scattered claws beneath; the pinniferous part, 60 cm. long, bearing 5—6 leaflets on each side of the rhachis; the rhachis is angular, rusty furfuraceous, irregularly armed beneath with solitary or ternate claws, the cirrus rather robust. The *leaflets* are all opposite, or nearly so (in 3 leaves), rigid-papyraceous, concolorous, or without any special indumentum on the lower surface, rhomboidal, cuneate in their lower half, and having the upper margin obtusely undulately-toothed, and suddenly terminated by an acuminate tip, have 7—9 radiating main nerves, and the transverse veinlets slender, and rather approximate; the lowest leaflets are the largest, 13—20 cm. long and 9—13 cm. wide;

the upper ones slightly smaller; the ansæ are 8—12 mm. long, thickish and apparently have been fleshy. Other parts unknown.)

HABITAT.—Dutch Borneo, collected by *Hallier* during the Borneo-Expedition, 1893-94 (Nos. 2135 in Buitenzorg Herbarium.)

OBSERVATIONS.—A very imperfectly known species, apparently related to *K. Wallichiæfolia* on account of its leaves having at the axilla of the petioles a very conspicuous callus, leaflets with very obtusely-undulately toothed upper margin and thickish, not flattened ansæ; it is moreover most remarkable for its opposite, or nearly so, leaflets; a character which, if constant and not purely accidental, would easily distinguish *K. Hallieriana* from any other.

PLATE 93.—Korthalsia Hallieriana *Becc.*—The entire type specimen No. 2135 in the Buitenzorg Herbarium.)

LATIN DIAGNOSIS.—Korthalsia Hallieriana *Becc.* sp. nov. Mediocris; vaginis fere inermibus, ocrea brevi, truncata, marcescenti, inermi; frondibus amplis, petiol longiusculo, callo axillari conspicue prædito; segmentis ansa crassiuscula suffultis-utrinque 5—6, plerumque oppositis, concoloribus, in margine superiori obtuse-undulato-dentatis.

22. KORTHALSIA FLAGELLARISED.—Miq. in Journ. Bot. Neerl. 15 and Prodr. Fl. Sum. 255, 591; Becc. Malesia, ii, 276. t. LXIV. f. 3; Hook f. Fl. Brit. Ind. vi, 476; Ridley, Mat. Fl. Mal. Penins. ii, 219.

K. rubiginosa Becc. Malesia, ii, 72; Ridley, l. c.;

K. angustifolia (not of Bl.) Miq. De Palm. Arc, Ind. 1526, excl. var. β

DESCRIPTION.—Of middling or rather large size. *Sheathed stem* 2—3 cm. in diameter. *Leaf-sheaths* smooth or more or less armed especially on the ventral side and at the base of the petioles with scattered small and short prickles, very thinly covered, when young, with a powdery down of a light cinnamon-brown colour, ultimately glabrous, thinly coriaceous on the dorsal and usually torn and disintegrated into a fibrous network on the ventral side. *Ocreæ* more or less covered with a tobacco-coloured detachable scurf, unarmed, but more or less prickly on their basal and ventral sides, exceptionally large, 20—30 cm. long, thinly membranous, non-inflated and embracing tightly the stem, almost entire, and truncate at apex in newly expanded leaves, split along the side and more or less marcescent, or dissolved into fibres later. The *leaves* of very young plants have the blade undivided, pluricostulate, very long-spathulate-cuneate, conspicuously white or white rubiginous on the lower surface, 50—60 cm. up to 1 m. long and 10—12 cm. broad; the apex rounded, and deeply toothed, and the base gradually tapering to a moderately long spinous petiole. The *intermediate leaves* of vigorous plants are large; 1—1·70 m. long in the pinniferous part, and end in a strong and long cirrus, powerfully armed with 3-nate or 5-nate robust claws; the petiole is flattened, 20—35 cm. long, 7—10 mm. broad, slightly concave or flat above, convex below, armed on the margins and below with rather robust claws. Rhachis more or less

rusty-furfuraceous, as is the petiole, clawed below. *Leaflets* numerous. 8—15 on each side of the rhachis, broadly linear or oblanceolate-cuneate or very narrowly and long-cuneate, irregularly truncate at apex or with a triangular acute and sharply dentate end, conspicuously scurfy-ferrugineous below, pluricostulate-plicate, 20—30 and at times even to 50 cm. long, and from 1 to 3 cm. broad; the basal leaflets in every leaf being often considerably narrower than the upper ones. The *upper leaves* of the adult plants have shorter and more distinctly cuneate leaflets, 20—25 cm. long, and 3—3·5 cm. broad near the upper end, which is triangular and accuminate and more or less deeply and sharply toothed, the teeth being subulate and nearly pungent. The *uppermost leaves*, those at the base of the inflorescence, are much reduced in length, have a short petiole, a short cirrus, and leaflets briefly cuneate, 3·5—4 cm. broad, and only 10—15 cm. long, and are more deeply plicate than the lower ones, but equally sharply toothed in their upper triangular end. Ansoe of the lower leaves 5—10 mm. long, but in the uppermost leaves they attain 2 cm. in length, and are very slender and strongly flattened. *Infloresence* simply branched, about 60 cm. long or more. Spathes tubular, closely sheathing, unarmed, the mouths truncate, branches arched, spreading, 15—25 cm. long, bearing 4—8 spikes. The *spikes* have a distinctly tomentose appearance, are thickish, 6 mm. in diameter (without the flowers) and 8—9 cm. long; spathels almost entirely immersed in the wool of the flower-bracteoles, and protruding only with their short apices. The *flowers* in the specimens examined are in too bad a condition for an exact analysis. *Fruits*—seen only when very young—are shortly beaked.

Habitat.—Malay Peninsula, Sumatra, Billiton and Borneo. This species was first described by Miquel from specimens collected by *Diepenhorst* at Priaman in Sumatra; Malay name "Rotan dahanan." Of the authentic specimens one was sent to me from the Herbarium at Utrecht, by the late Prof. Rauwenhoff (No. 2584 Herb. Bogor.). From the same source I have seen specimens in the Herbaria of Leyden and Calcutta. It has been found in Sumatra at Palembang (*Heyne* No. 19, Herb. Becc. ex Herb. Buitenzorg. Specimen with radical entire leaves); in the Malay Peninsula in the District of Perak (*Scortechini* in Herb. Becc., specimen with very long and narrow leaflets), at Assam Kumbang plain (*Wray* No. 3127 specimen with very young fruits); in Johore on Mt. Austin (*Ridley* No. 12591—this number was referred by Ridley to *K. rubiginosa*); in Billiton (*Heyne* No. 2 in Herb. Becc. ex Herb. Bogor.—sterile specimen with long and narrow leaflets). In Borneo it seems a rather common plant, in Sarawak in Mt. Mattang near Kuching (*Becc.* P. B. No. 1912;—this is the type of *K. rubiginosa* Becc.;—the specimen belongs to a not full grown plant, and has very narrow and long leaflets); similar to P. B. No. 1912 are the specimens collected by *De Vriese* also in Borneo, which were by Miquel referred to *K. angustifolia*; and Heyne's No. 2528 from Pontianak, and Nos. E and E bis from Bandjermain Buitenzorg Hebarium.

Observations.—A very fine plant, owing to its large leaves having numerous leaflets, always conspicuously discolorous of a deep green above and intensely rusty-furfuraceous beneath, but very variable in size and shape, from linear to more or less cuneate, but in every case sharply toothed in their upper margins. *K. rubiginosa* Becc. in undoubtedly the not yet full grown stage of

K. flagellaris Miq. The leaflets, very narrow and long in half-grown plants, become gradually shorter and more distinctly oblong cuneate higher up, as the plant approaches the fruiting stage; at that time the leaves nearer the infloressence become so different from those of the lower part of stem as to appear to belong to a different species. The inflorescence is rather large, with spreading branches and distinctly tomentose spikes. It is apparently a rather common plant, but has very seldom been found in a fertile condition, and never with mature fruit, probably because the canes, as is the case with other *Korthalsias*, are much used by the natives, and cut down before they attain the flowering stage.

PLATE 94.—Korthalsia flagellaris *Miq.*—Terminal part of an infloresence; one of the uppermost leaves of the fertile plant. From No. 3127 in the Perak Herbarium.

PLATE 95.—Korthalsia flagellaris *Miq.*—Portion of the sheathed stem and an entire leaf from a not yet fertile plant (on the left side of the plate). This is the type of *K. rubiginosa* P. B. No. 1912 in Herb. Beccari. Another portion of a sheathed stem of a plant older than the preceding, and portion of a leaf near the end (on the right-hand side of the plate); from No. 47 of Buitenzorg Herbarium in Herb. Beccari.

PLATE 96.—Korthalsia flagellaris *Miq.*—Lower part of a young plant with primordial leaves; from P. B. No. 1912 in Herb. Beccari.

23. KORTHALSIA ZIPPELII Bl. Rumphia, ii, 171, t. 130, f. 2; Mart. Hist. Nat. Palm. iii, 211,343; Miq. Fl. Ind. Bat. iii, 76 and De Palm. Arc. Ind. 26; Walpers Ann. iii, 492; Becc. Malesia i, 87 and ii, 69; Hemsley in Voy. Challenger, Bot. i, III, 225; K. Sch. et Lauterbach, Nachtr. Fl. Deut. Schutzg. (1905) 61.

Ceratolobus Zippelii Bl. l. c. t. 130, f. 2.

C. plicatus Zipp. ex Bl. l. c.

Ceratolobus sp. Becc. Malesia, ii, 69 (Osserv.).

DESCRIPTION.—A large species. *Sheathed stem* 2—3 cm. in diameter. *Leaf-sheaths* sparingly armed with short straight spines especially on their ventral side near the insertion of the petiole, also very thinly covered when young with a fugacious powdery indumentum, ultimately becoming glabrous. *Ocreæ* tubular, 20 cm. or more long, rather closely armed with short straight spines especially in their basal part, which is more or less of a coriaceous structure, whereas the remainder is thinly membranous, lacerated and soon broken up into filaments. *Leaves* large, one from the intermediate part of an adult, but not yet flowering plant has a petiole 40 cm. long, the pinniferous portion measures 1 m. in length, is prolonged into a robust cirrus about as long, and bears 7 leaflets on each side of the rhachis; the petiole is somewhat flattened, about 1 cm. broad, convex and smooth beneath, prickly on the edges and occasionally also on its upper flattish surface; it is, as well as the rhachis, covered with a very thin, whitish, fugacious indumentum; the rhachis is armed with scattered single claws; the cirrus is very irregularly but closely

clawed, some of the claws being 3-nate or 5-nate and intermingled with other single and scattered claws. *Leaflets* rigid-papyraceous, conspicuously discolourous, green above, chalky white beneath, broadly cuneate-oblong or cuneate-rhomboidal, having their upper ends triangular and sharply toothed ; a few of the lower leaflets in every leaf are more approximate and smaller and narrower than the others ; the intermediate leaflets measure 25—32 cm. in length, by 12—15 cm. in breadth. and have 12—13 equally strong main nerves ; transverse veinlets not very distinct ; the uppermost leaves are much reduced in size, have short petioles and smaller leaflets than the lower ones but equally numerous ; the ansœ in the lower leaves are short, but in the upper ones are very strongly flattened or laminar, 10—15 mm. long and have a very distinct axillary callus, with a transverse fissure, leading to an internal cavity. *Inflorescence* large, 70 cm. or more long, composed of several robust, spreading primary branches, 30—60 cm. long; spathes of the branches tubular-infundibuliform, short, partially covered with a tobacco-coloured detachable scurf ; unarmed, coriaceous in their lower part, but prolonged above into a membranous, dry, lacerate limb. From inside the mouth of every primary spathe springs a shortened branchlet, bearing radiately 5—6 spikes in the lower part of the branch, and gradually fewer above ; the branchlets are flattened, very short, not or only very slightly produced beyond the mouth of their spathes and are provided with their own secondary spathes. The *spikes* are thickish, 8—10 cm. long, 12—13 mm. broad with and 8—9 mm. without the flowers, and in this second case are of a tomentose appearance ; spathels very broadly triangular, ciliate on the margins and with their acute apices projecting above the wool of the flower-bracteoles. *Flowers* very regularly and closely spirally arranged in 12 longitudinal series, 6 mm. long, 2·5 mm. broad, obtusely trigonous, narrowing to a subacute apex ; the calyx cyathiform, entirely hidden by the wool of the bracteoles, deeply parted into 3 ovate, very thinly membranous, acute lobes, which are very finely-striately veined and have hyaline margins ; the corolla is nearly 3 times as long as the calyx, deeply divided into 3 cartilaginous segments, finely striate outside ; the stamens have thick and short triangular filaments, united to the short undivided basal part of the corolla ; anthers long-sagittate, acute ; ovary ovoid, narrowing above to a conical sulcate acute style, reaching about half way of the anthers. *Fruit* unknown.

HABITAT.—It seems to be rather common all over New Guinea, showing a great uniformity of characters, even in regions far apart.

It was discovered first by *Zippell* at Lobo in Dutch territory, in the south of the Island, and found again in the same region in Etna bay, by *Koch* (Leyden Herbarium). I have collected it (sterile) in the N.-W. at Ramoi near the Island of Salwatti, and in flower at Andai near Dorei. Exactly similar to the typical specimens are those collected by *Lauterbach* in Kaiser Wilhelm's land on the Ramufluss (No. 2561 in Berlin Herbarium) and in British New Guinea on the Owen Stanley's Range, by Sir *W. McGregor* in 1889 (Herb. Becc.) and afterwards by *Giulianetti*.

OBSERVATIONS.—It is one of the largest species, distinguishable by its leaf-sheaths prolonged into a closely sheathing, elongate, finally lacerated ocrea ; by its large leaves having numerous, oblong-cuneate or cuneate-rhomboidal leaflets,

white beneath, and having 12—13 equally strong main nerves; by the large panicle composed of some robust main branches, sheathed with short, lacerated primary spathes whence the spikes issue radiately, borne on shortened secondary branches, not produced beyond the mouths of the primary spathes; by the spikes being thickish and tomentose, and by the flowers rather distinctly trigonous, but with obtuse angles.

It seems more closely related to *K. laciniosa* than to any other species.

PLATE 97.—Korthalsia Zippelii *Bl.*—Portions of the inflorescence in flower. From a specimen collected by me at Andai.

PLATE 98.—Korthalsia Zippelii *Bl.*—Portion of the sheathed stem and base of a leaf; a separate leaflet, one of the middle and largest; from the sterile specimen collected by me at Andai (Herb. Beccari).

KORTHALSIA ZIPPELII var. ARUENSIS Becc.
Korthalsia sp. Becc., Malesia, i, 87.

DESCRIPTION.—*Stem* and *leaves* as in the type. *Inflorescence* large, having the secondary branches not very elongate, and forming rather dense ovate panicles, 20—25 cm. long (or at times more?); the spathes are as in the type, and from the mouth of each issues a single spike-bearing branchlet, 5—7 cm. long, bearing alternately and at different levels 3—6 spikes. The *spikes* are also similar to those of the type. The *fruit* is small, 12—13 mm. long (not taking into account the beak), and 10 mm. broad, obovoid-turbinate, attenuate at the base, rounded or flattish on the top, and very suddenly surmounted by a slender, almost pungent beak, 2 mm. long; the scales are in 15 longitudinal series, the largest 3·5 mm. wide, of a yellowish straw colour, strongly convex, especially in their posticous part, broadly grooved along the centre, the apices slightly produced, very appressed, the margins very finely ciliate-fringed. *Seed* globular, 7 mm. in diameter, its surface slightly impressed by about 6 longitudinal veins, narrowly and deeply grooved along the raphal side; the intrusion of the integument is large and deep; albumen homogeneous, horse-shoe shaped in longitudinal section; embryo relatively large, lateral and central.

HABITAT.—Collected by me in May 1873 at Giabu-lengan in the Aru Islands.

OBSERVATIONS.—In the typical *K. Zippelii* from the main land of New Guinea, the main branches of the inflorescence are divided into several superposed very short spike-bearing branchlets, which just at the level of the mouth of their respective spathes bear radiately and almost at one level, 4—5 or fewer spikes; whereas in the variety the spike-bearing branchlets form a dense ovate panicle, and the branchlets are considerably exserted from the spathes, and bear the spikes alternately and at different levels. When better known this variety may prove to be a distinct species.

PLATE 98.—Korthalsia Zippelii VAR. aruensis *Becc.*—The fruiting panicle only. The type specimen from Giabu-lengan in Herb. Beccari.

24. KORTHALSIA ROBUSTA Bl., Rumphia, ii, 70. (partly as to the leaves) t. $\frac{157}{B}$; f. 3, and analysis 1—9; Mart. Hist. Nat. Palm. iii, 211 (2nd edit.) t. 172 III (ic. it. e Bl.); Miq. Fl. Ind. Bat, iii, 76; Prodr. Fl. Sum. 255; De Palm Arc. Ind. 26; Walp. Ann. iiii, 492; Becc. Malesia, ii, 72.

K. hispida Becc. Malesia, ii, 71—?

DESCRIPTION.—Apparently of middling size. *Stem-leaf-sheaths*, and *leaves* unknown but probably much like the corresponding parts of *K. macrocarpa*. The *spikes* are cylindraceous, large and thick, blunt at apex, 21 cm. long in Blume's figure; after the fall of the corollas the spathes remain visible, and not being appressed, the spikes assume a squarrose appearance and measure nearly 3 cm. in diameter. The spathels are large, 12—13 mm. long, and about as broad, dry, papery, finely striate, concave, very broadly triangular in their upper halves, which soon split longitudinally and appear lacerated. The floral bracteoles are slightly falcate, covered densely at apex and on the keeled back with paleaceous, not woolly, hairs. *Flowers* relatively large, 15 mm. long, protruding slightly from their respective spathes; the calyx, 6·5 mm. long, persistent after the fall of the corolla, oblong or obovoid, deeply parted into 3 oblong, concave, very blunt, cartilaginous lobes; the corolla is two and a half times as long as the calyx, clavate and rounded above when in bud, parted down to about the middle into 3 oblong or spoon-shaped cartilaginous obtuse strongly-striate segments; in its lower part it is fleshy, tubular and closely sheathes the ovary and the style, but soon goes to decay, whereas the upper part falls down immediately after the anthesis; the stamens are inserted about mid-way of the corolla at its throat, where they form a thick ring or collar, crowned by 6 thick and short teeth, but leaving a central opening for the passage of the style; the anthers are broadly linear, auricled at the base, blunt or only very obsoletely apiculate; the ovary is ovoid, and rather suddenly attenuate into a rigid angular and longitudinally grooved style ending in 3 short, acute connivent stigmas, which stop just level with the opening in the centre of the stamina ring, not even attaining the bases of the anthers.

HABITAT.—Blume writes that the spike, upon which the species must be considered as established, was collected by *Prætorius* in Palembang, in S.-E. Sumatra.

OBSERVATIONS.—*K. robusta* was established by Blume from mixed material, consisting of portions of leaf-sheaths and non-cirriferous leaves (which consequently beloged to juvenile plants) derived from Java, Sumatra and Borneo, and of the flowering spike mentioned above. I have examined this material of Blume, and apparently only one leaf, coming from Sumatra, belongs to *K. robusta*; another leaf, from a Javan plant, most probably belongs to *K. Teysmannii*, to which also, apparently, belongs the ocreæ attributed by Blume to *K. robusta*. Considering the great affinit of *K. robusta* with *K. macrocarpa* and *K. squarrosa* it is to be presumed it would be provided with the peculiar kind of ocrea proper to the latter species. I think that *K. hispida* Becc. from W. Sumatra, of which the flowers and fruits are unknown and which is represented by specimens of juvenile plants only (see *K. hispida* Becc, among the doubtful species) is most probably to be reduced to

K. robusta. Closely allied to *K. robusta* are *K. squarrosa* and *K. macrocarpa*, especially the latter; but *K. robusta* is distinguishable from both in having the style closely enwrapped by the thickened tube of the corolla and not protruding with its apex during the anthesis beyond the opening in the centre of the ring formed by the connate bases of the filaments; whereas in the other two, but more especially in *K. macrocarpa*, the style is loose in the tube of the corolla, and with the apices of the stigmas reaches to about midway of the anthers.

PLATE 99.—Korthalsia robusta *Bl?*—The type specimen upon which *K. hispida* was established. See also in the figures 7-8 in the analytical plate IV, representing the flower of the typical specimen of *Korthalsia robusta* Bl.

25. KORTHALSIA MACROCARRPA Becc. n. sp.

K. robusta (non Bl.) Becc. in Winkler, Beitr. Fl. Born. in Engl. Bot. Jahrb. 48 (1912) 93.

DESCRIPTION.—Scandent and rather large. *Sheathed stem* of the flowering plant 2—2·5 cm. in diameter. *Leaf sheaths* armed, especially on the dorsal side, with scattered, very slender, blackish, lustrous spiculæ, 5—12 mm. long, resting on a tuberculiform base. *Ocreæ* extraordinarily long (20—40 cm.), rigid, thinly coriaceous or subpergamentaceous, not inflated, and having the shape of a narrow and long horn, or of an elongated ass's ear, gradually acuminate to an obliquely truncate point, unclosed all along their ventral side, so as to be incompletely clasping, and covered all over with very slender, scatttered spiculæ similar to those occurring on the leaf sheaths but very often longer. *Leaves* large; those of the upper part of the adult plant are cirriferous, have the petiole rather elongate (20—30 cm., long 7—8 mm. broad), more or less prickly, complanate, flat above, slightly convex beneath, and with sharp edges; the rhachis is armed beneath with scattered, black-tipped claws; the *leaflets* are numerous, green above, white beneath, very conspicuously ansate; the lower leaflets in every leaf are considerably longer than broad, oblong cuneate or cuneately-rhomboidal, the blade alone being 20—25 cm. long, 5—6 cm. broad; the intermediate and upper leaflets are more regularly rhomboidal than the lower, not much longer than broad (15—18 cm. long, 10—12 cm. broad); all have 11—13 radiating main nerves, and the upper margin irregularly and rather sharply erose-toothed, the teeth terminating the main nerves being very acute and often aristate. The leaflets on the leaves from young plants are narrow and relatively longer than those of the adult plant, and are more distinctly chalky white underneath; their ansœ are always unusually long and slender, as much as 5—6 cm. in length, and not more than 2—3 cm. in breadth; in the uppermost much reduced leaves the ansæ are still longer, and more slender, and being strongly flattened, probably cause the blade to assume a quivering motion, as is the case with the leaves of *Populus tremula.* The inflorescence is apparently composed of several approximate primary branches; one of these seen by me is 25 cm. long, is divided into 4 secondary branches, very short and approximate, each branch bearing 2 spikes, the whole forming a very compact, recurved panicle. The spathes are large, have a very short tubular basilar part, and a very broad, strongly concave embracing ovate acute or acuminate dry rigid papyraceous limb, are cinnamon brown internally and light coloured, glabrescent, smooth or slightly

spinulous externally; the lower spathes are 15—20 cm. long; the upper gradually smaller. The *spikes* are very thick and relatively short, 12—14 cm. long, blunt at apex, very closely covered with flowers so as to conceal entirely the spathels; just at the time of blooming the spikes are 3—3·5 cm. in diameter, but only about 2·5 cm. after the fall of the corollas; it is at this period that they assume a squarrose appearance; the spathels are large, 1 cm. long and about as broad, dry, papery-membranous, concave, very broadly triangular in their upper halves, acute, frequently split longitudinally, finely striate, and often shortly connate at the base by their margins. The floral bracteoles are narrow, elongate, very slightly falcate, striate, covered densely at apex and on the keeled back with paleaceous, not woolly, hairs. *Flowers* relatively large, 15—16 mm. long, arranged in several longitudinal series (about 15), protruding, during the anthesis, by the full length of the corolla beyond their respective spathels; the calyx is 5·5—7 mm. long, oblong, attenuate a little at the base, deeply parted into 3 oblong, concave, very blunt, thinly cartilaginous lobes; the corolla is two and a half times as long as the calyx, when in the bud and when fully developed is clavate, 5 mm. broad, rounded on the top, parted down to about the middle into 3 oblong or spoon-shaped, thickish, cartilaginous, very obtuse, strongly striately veined segments; it is fleshy and marcescent in its lower tubular part; the stamens are inserted at the throat of the corolla at the beginning of its tubular part, where the filaments are united together, and form a ring or collar, crowned by 6 thick and short teeth; the anthers are erect, obsoletely apiculate, broadly linear, 5 mm. long, auricled at the base; the ovary is elongate-ovoid, and narrows gradually above to a conspicuous rigid style, angular, deeply grooved longitudinally and ending in 3 subulate, very sharp, connivent stigmas, which protrude beyond the throat of the corolla and reach to about midway of the anthers. *Fruits*, relatively large (the largest known in the genus), obovoid-turbinate, broadest in their upper third part, and thence gradually tapering to a rather narrow base, which is rendered more or less obtusely angular by their mutual pressure; they are broadly conical above and end in a slender, rigid, pungent beak; they measure 4 cm. in length, including the beak, and 2—2·5 cm. in diameter; the scales are in 18 longitudinal series, are glossy, slightly convex, not or only very faintly grooved along the centre, spadiceous in their posticous part, with the margins and apices chestnut brown, and the latter broad, rounded or slightly produced, lacerate-toothed, not very appressed. The scaly epicarp on the whole is rather resistent (not brittle) and includes a rather abundant mesocarp, spongy in the dry condition. The *seed*, smaller than would be expected from the size of the entire fruits, is 17—20 mm. long, 11—13 mm. broad, irregularly ovoid, narrowing a little above, acute or bluntish at apex, rounded at the base, and has the surface slightly uneven; albumen homogeneous, very hard; the integument penetrates deeply into the middle of the albumen in the form of a very narrow lamella running along the whole of the raphal side; embryo in the centre of the antiraphal side, relatively large, 3 mm. long, 2 mm. broad.

HABITAT.—Borneo. It was collected with mature fruits in July 1908 by *Dr. H. Winkler*, No. 2777 between Kundim Baru and Batu Babi in the S.-E. of

the Island, and with flowers by *Heyne* at Bandjermasin in the south (No. 22 bis in Buitenzorg and Beccari Herbarium) and sterile at Pontianak in the West (*Heyne* No. 2543 in Buitenzorg and Beccari Herbariua).

OBSERVATIONS.—I consider the species established upon Winkler's fruiting specimen No. 2777, which is accompanied with fragments of leaves having cuneately-rhomboid leaflets, considerably longer than broad, the largest of which are 25—30 cm. long, 7 cm. broad, the ansæ being 12—15 mm. long. The old flowers still remaining on the fruiting spikes are 18—19 mm. long, the calyx alone measuring 8 mm., other wise as described above. On Heyne's specimen No. 22 bis I have mostly based the description of the flowers; these in one specimen (that represented in plate 100) are constantly 15 mm. long; but in one flowering branch bearing only two spikes (evidently, however, of the same collecting as the above) the flowers are 18 mm. long or as long as those of Winkler's fruiting specimen. I cannot attach much importance to this discrepancy in size of the flowers as a diagnostic character, but I suggest that it may represent, perhaps, a case of dimorphism of the flowers for promoting cross-fertilisation, to which apparently insects are not extraneous, as I have constantly found that all the flowers I dissected had had the fleshy parts at the throat of the corollas destroyed by their agency.

In Heyne's specimen No. 22 bis, the portions of the leaves, which evidently belong to the upper part of adult plants, have rhomboidal leaflets, slightly longer than broad and with extraordinarily long ansæ. In the sterile specimen from Pontianak (Heyne No. 2543) the leaflets are cuneately-rhomboidal as in Winkler's, but the ansæ are somewhat longer than in his specimen; the unusually long and peculiar horn-shaped ocrea is very similar in all the above-mentioned specimens, and this seems to me the best argument for considering them all conspecific.

The spikes laden with fruits look more like those of a *Zalacca* than those of a *Korthalsia*, and the great development of the spathels also contributes to this resemblance.

The specific characters of *K. macrocarpa* are the moderately large size; the ocreæ so extraordinarily long, horn-shaped, unclosed on the ventral side, and narrowing in their upper part, armed with slender black spiculæ; the leaves having leaflets green above and conspicuously mealy-white beneath, cuneately-rhomboidal or rhomboidal, long ansate; the thick, squarrose spikes, having large spathels and non-woolly flower bracteoles; the large flowers in which the apex of the stigmas reaches to about midway of the anthers; the large obovate-turbinate fruit; the seed deeply penetrated by a laminar intrusion of the integument.

K. macrocarpa differs from *K. squarrosa* by its considerably longer horn-shaped ocreæ, by the larger flowers, and by the very elongate ansæ; from *K. robusta* it differs by the larger flowers having the apex of the stigmas considerably surpassing the throat of the corolla.

PLATE 100.—Korthalsia macrocarpa *Becc.*—Ocrea entire, and the basal portion of a leaf, from a full-grown and fertile plant; portion of the panicle composed of 3 spike-bearing branchlets; another portion with only one spike. From Heyne's specimen No. 22 bis of the Buitenzorg Herbarium in Herb. Beccari.

PLATE 101.—Korthalsia macrocarpa *Becc.*—Portion of the fruiting panicle; from Winkler's No. 2777. Portion of a leaf from a middle-aged plant (note its extraordinary long ocrea); from Heyne's No. 22 bis in Herb. Becc.

PLATE 102.—Korthalsia macrocarpa *Becc.*—Sterile specimen from Heyne's No. 2543, collected at Pontianak (Herb. Beccari). See also in the analytical plate IV the analyses of the flower and fruit of *K. macrocarpa*, figs.—6.

LATIN DIAGNOSIS.—Korthalsia macrocarpa *Becc.* sp. nov. Mediocris; vaginis spinis nitidis nigrescentibus armatis, ocrea magna, elongata, superne attenuata in parte ventrali aperta, spiculis parvis nigris armata; segmentis longe ansatis, cuneato-rhombeis, subtus albicantibus; spicis majusculis, squarrosis, spathellis glabris; floribus pro rata majusculis, stigmatibus ex corollæ fauce prodieuntibus et circiter dimidiam antherarum partem attingentibus; fructibus magnis, obovato-turbinatis, rostro pungenti terminatis.

26. KORTHALSIA SQUARROSA Becc., Notes on Philip. Palms in Philip. Journ. of Sc. (Bot.) iv (1909) 620.

DESCRIPTION.—Of middling size. *Sheathed stem* 20—22 mm. in diameter. *Leaf sheaths* armed, especially on the dorsal side, with scattered, very slender blackish-lustrous spiculæ, 5—12 mm. long, resting each on a tuberculiform base. The *ocrea* (in one specimen) is 12 cm. long, not inflated, subcylindrical, narrowing very little above (not ass-ear like), truncate at apex, not clasping completely the sheath, being unclosed all along the ventral face, polished, chestnut-brown and dull inside, externally straw-coloured and covered all over with very slender scattered spiculæ, similar to those on the leaf sheaths, but very often longer; in old stems, the ocreæ are more or less destroyed by age. *Leaves* of the adult flowering plant rather large and cirriferous, about 70 cm. long in the pinniferous part; petiole 10—12 cm. long, 8—10 mm. broad, more or less prickly, complanate, flat above, slightly convex beneath; the margins rather sharp; the rhachis armed beneath with scattered, back-tipped claws. *Leaflets* 6—7 on each side of the rhachis, green above, conspicuously white beneath, rhomboidal (15—18 cm. long, 10—12 cm. wide) or cuneately rhomboidal (20—25 cm. long and 7—8 cm. wide), with 11—13 main radiating nerves; the upper margins are irregularly and rather sharply erose-toothed, the teeth terminating the main nerves being very acute and often aristate; the two lowest leaflets in every leaf are considerably smaller than the others; the ansoe are rather short (5—10 m. long) and strongly flattened. The *inflorescence*, of which only a few spikes were preserved, is apparently very much like that of *K. macrocarpa*, and is composed of spikes in pairs at each secondary branch. The *spikes* are cylindraceous, thick and short, with a blunt apex, 10—11 cm. long (not 20 cm. as has been stated in the Ph. Journ. of Sc. l. c.) and with the flowers 25—27 mm. in diameter; after the fall of the corollas the spathels remain visible, and these not being appressed, the spikes assume a squarrose appearance and measure in that condition 2 cm. in diameter; the spathels are large, 8—9 mm. long, dry, papery-membranous, concave, broadly triangular in their upper part, acute, usually split

longitudinally along the centre, finely striate; the floral bracteoles are narrow, elongate, very slightly falcate, covered densely at apex and on the keeled backs with paleaceous, not woolly, hairs. *Flowers* relatively large, 13 mm. long, protruding during the anthesis by the full length of the corolla above their respective spathels; the calyx is oblong, parted to the middle into 3 broadly ovate, obtuse, thinly cartilaginous lobes; the corolla is two and a half times as long as the calyx; when in bud fully developed it is clavate and about 5 mm. broad, rounded on the top and parted down to about the middle into 3 oblong or spoon-shaped, thickish cartilaginous, very obtuse, strongly striate segments; it is fleshy in its lower undivided part; the stamens are inserted at the throat of the corolla, where its tubular part begins, and where also the filaments are united together to form a ring or collar, crowned by 6 thick and short teeth; anthers erect, 5 mm. long, linear or linear-sagittate, apiculate, auricled at the base; the ovary is ovoid and narrows above gradually into a rigid style, angular and grooved longitudinally, ending in 3 briefly subulate, connivent stigmas, which usually protrude beyond the ring formed by the filaments of the stamens at the throat of the corolla, and apparently reach to about midway of the anthers (the analysis of the flowers in the specimens at my disposal was, however, very difficult, as all had been infested by insects, which had destroyed all the fleshy parts of the flower, leaving only the ovary untouched). *Fruit* unknown.

HABITAT.—The Philippines. In Palawan near Jwahig (*Curran* No. 7185—May 1906 in the Manila and Beccari Herbaria); and in Balabac Island (*Merrill* No. 5384 in the Manila Herbarium).

OBSERVATIONS.—The type specimens—Curran No. 4185 consist in a few detached spikes and fragments of stem and leaves. In these specimens the leaflets are cuneate-rhomboidal, considerably longer than broad, and the stems have had their ocreæ destroyed by age; I consider, however, as conspecific with it the sterile specimen collected by E. D. Merrill (No. 5384) on Balabac Island, provided with the well conformed ocreæ described above, but bearing broader and more regularly rhomboidal leaves than Curran's No. 4185.

A note of Merrill's annexed to his specimen No. 5384 informs us that ants live in the ocreæ, which, however, are not inflated, and that a quantity of rubbish is accumulated by the ants among the spines that cover the surfaces of the ocreæ.

K. squarrosa is related to *K. robusta* Bl. of Sumatra, and to *K. macrocarpa* Becc of Borneo, and forms with these two a small group, characterized by the spikes looking quite different from those of the great majority of *Korthalsias*, owing to their large loose imbricating spathels, and also to the floral bacteoles not being woolly.

K. squarrosa differs from *K. robusta* in the shorter truncate ocreæ, in the smaller spikes, and in the flowers having the style produced above the throat of the corolla; with *K. macrocarpa* it agrees in the flowers, but differs, as from *K. robusta*, in the shorter truncate ocreæ.

The diagnostic characters of *K. squarrosa* are : the subcylindrical not entirely clasping, truncate ocreæ (not ass-ear like) ; leaflets cuneately rhomboidal or rhomboidal, green above, white beneath ; the ansæ rather short (5—10 mm. long) ; the spikes thick and squarrose ; the spathels large, loosely imbricating ; the floral bracteoles covered with paleaceous, not woolly, hairs ; the flowers, 13 mm. long having the style produced beyond the throat of the corolla.

PLATE 103.—Korthalsia squarrosa *Becc.*—Small portion of the sheathed stem with an almost entire leaf and the entire ocrea (from Merrill's No. 5384) ; spikes still keeping some of their flowers, from Curran's No. 4185.

DOUBTFULL, INPERFECTLY KNOWN OR UNRECOGNIZED SPECIES.

KORTHALSIA GRANDIS Ridley, Mat. Fl. Mal. Penins. ii, 217.

DESCRIPTION.—A specimen of *K. grandis* Ridley, presented to me by Mr. Ridley himself, has the *sheathed stem* 5 cm. in diameter, the *ocrea* 13 cm. long, truncate, rigid pergamentaceous, partially disintegrated into fibres above and on the ventral side, armed with few, but large, short, flattened spines ; the *leaves* are exactly alike the intermediate ones of the adult plant of *K. Teysmannii* and the *leaflets* are also of the same size, form, and colour. Ridley states that the *spadix* has long and thick tomentose *spikes*, with the wool nearly as long as the bracts (and in this also it agrees with *K. Teysmannii*), but the *fruit* is not described ; we therefore lack the most important and reliable character wherewith to differentiate *K. grandis* from *K. laciniosa* as well as from *K. Teysmannii* and *K. ferox*. Considering, however, that several of the palms growing in Singapore are identical with those of east Sumatra, the home of *K. Teysmannii*, the conspecificity of *K. grandis* with that palm appears probable.

HABITAT. Singapore at Selitar and Bukit Mandai (*Ridley*)

PLATE 88.—Korthalsia grandis *Ridley*.—Mr. Ridley's specimen in Herb. Beccari .

KORTHALSIA MACHADONIS Ridley, Mat., Fl. Mal. Penins. ii, 216.

Of this very inperfectly known *Korthalsia* Ridley writes : " Stem slender, ochrea cylindric, 1½ inch long, thorny ; petiole a foot long, very thorny, with short thorns crowded, white, with a scurfy meal when young ; leaflets alternate, remote, 12, the two lowest smallest, the terminal ones connate broad, the others cuneate, rhomboid bidentate with a long point, 6 inches long, and 3 inches wide, no petiole " (ansa ?—Becc.) "

" Perak : Kamuning (*Machado*).—A young plant sent by Mr. Machado. It is very different from *K. scaphigera*.

This may be an early stage of *K. ferox* VAR. *malayana* Becc.

KORTHALSIA HISPIDA Becc. Malesia, ii, 72.

DESCRIPTION.—*Sheathed stem* 10—12 mm. in diameter. *Leaf-sheaths* armed, especially on the dorsal side, with short back spines. *Ocrea* 20—22 cm. long, dry, papyraceous, in the shape of a very narrow and long horn, gradually narrowing

above to a bilobed apex, not inflated, unclosed all along the ventral side, except in a short basal closely sheathing part, glossy and of a chestnut colour inside, covered externally with extremely minute hair-like spinules, and armed also with scattered, black, unequal spiculæ, 2—3 cm. long, or shorter. The *leaves* have a slender and not long cirrus; the petiole is 17—18 cm. long, 4 mm. broad, flat above, convex, and slightly clawed beneath, the pinniferous part is about 50 cm. long. *Leaflets* 4 on each side of the rhachis, green above, white beneath, elongate or cuneately-rhomboidal, 16—20 cm, long, 6—7 cm. broad (the 2 lowest narrower), very acuminate; the margins sharply erose-toothed; the ansœ short, 2—5 mm. long.

HABITAT.—West Sumatra at Ayer Mantjor in the Prov. of Padang, at 360 m. above sea level (*Becc.* P. S. No. 673 sterile.)

OBSERVATIONS.—Very probably it represents the juvenile stage of *K. robusta* Bl.—See observations on that species, and Plate 99.

KORTHALSIA ROSTRATA Bl. Rumphia ii, 168; Mart. Hist, Nat. Palm. iii, 211; Miq. Fl. Ind. Bat iii, 75, De Palm. Arc. Ind. 26; Walp. Ann. iii, 492; Becc. Malesia, ii, 76.

This is *Ceratolobus rostratus* Becc.—See observations under that species.

KORTHALSIA ANGUSTIFOLIA β gracilis Miq. De Palm. Arc. Ind. p. 16.

I have identified this with *K. echinometra* Becc.—See observations under that species.

KORTHALSIA ANGUSTA. β ex. Kurz Enum. Burm. Palms in Journ. As. Soc. Beng. N. xliii, p. II, 1874, p. 207 is evidently a misprint for *K. angustifolia* Bl.

KORTHALSIA LACINIATA.—In Miq. Fl. Ind., Bat. iii, 77, is a misprint for *K. laciniosa* Mart.

KORTHALSIA. sp. Vial No. 4066, from Sorsogon in Luzon.—See Beccari in Philipp. Journ. of Sc. (Bot.) iv, (1909), 621.

The specimen in my Herbarium consists only of the intermediate portion of a leaf having large rhomboidal leaflets, white beneath and with flattened rather short ansæ, resembling on the whole those of *K. squarrosa* Becc.

KORTHALSIA FLABELLUM Miq. ex kerch. Palmiers, p. 59=*Licuala Flabellum* Mart.

KORTHALSIA CELEBICA Miq. ex. Kerch. Palmiers, p. 59=*Licuala celebica* Miq.

KORTHALSIA PENDULIFLORA Miq. ex Kerch Palmiers, p. 59=*Licuala penduliflora*.

Metroxylon Rottb.

Rottb. in Nye Sam. Dansk. Videns. Selsk. Skrift. ii 525, t. 1; Mart. Hist. Nat. Palm. iii, 213, 343 (excl. Sect. *Pigafetta*) t. 102, 159; Kunth Enum. Pl. iii, 213 (excl. sp.); Griff. Palm. Brit. Ind. 21, t. 181; Miquel Fl. Ind. Bat. iii, 139 (excl. Sect. 2); Becc. Malesia, i. 91 and in Nuovo Giorn. Bot. Ital. iii, 29; Benth. et Hook. Gen. Pl. iii, 935; Hook. f. in Fl. Brit. Ind. vi, 481; Drude in Engl. et Prantt, Pflanzenf. 1. 47 (with *Coelococcus* as a Subgenus).

Sagus Bl. Rumphia, ii, 146 (excl. Sect.) t. 86, 126, 127; Turpin Dict. Sc. Nat. (Botanique) t. 32, 33.

Coelococcus H. Wendl. in Bonpl. 1862, 199; Warburg in Bericht Deut. Bot. Gesell. xiv (1896), 140 t. X; Heim. in Bull. Agr. Col. Soc. Franc. de Colonies (extract) 1902, f. 1—5.

Arborescent, monœcious, more or less spinous palms, having a columnar trunk, and large pinnate leaves. *Leaves* having a large broadened basilar part, clasping but not completely sheathing the trunk, spinous or smooth; petiole robust, channeled above spinous or smooth. *Leaflets* numerous, ensiform, straight, acuminate, having a mid-costa prominent spinulous or nearly smooth on the upper surface, and several secondary nerves; the margins acute, spinulous or nearly smooth. *Inflorescence* very large, terminal, arising from the centre of the leaf crown, usually composed of several main branches issuing from the axillas of the uppermost much reduced leaves; the primary branches are sheathed by spathes, tubular in their lower part, unclosed above; the secondary branches bear, alternately and distichally, the spikes, and are also provided with tubular spathes. *Spikes* amentiform, cylindrical, bearing monœcious flowers in pairs, spirally arranged in the axillas of broad membranous very approximate bracts or spathels, which are more or less connate; every pair of flowers is provided with its special bracteoles, usually densely villose or reduced to tufts of hairs. The *flowers* of every pair are collateral, and externally quite the same; one of each pair is, however, male and the other hermaphrodite in appearance, but physiologically only female; both kinds of flowers are symmetrical and thinly coriaceous, have the calyx cyathiform campanulate, and more or less deeply 3-lobed; the corolla longer than the calyx, and more or less deeply parted into 3 valvate segments, but always undivided and campanulate or urceolate in its basal part. The *male flowers* open before the female and have the filaments connate and adnate to the undivided part of the corolla, the free part of the filaments is elongate and briefly inflected at apex; anthers elongate, dorsifixed, versatile, with parallel cells opening longitudinally and laterally; rudimentary ovary very small, represented by 3 very small papilliform bodies. *Female* or *pseudo-hermaphrodite flowers* opening after the fall of all the male ones; calyx corolla and stamens are exactly as in the male flowers; ovary ovoid or turbinate, narrowing above into a thick acuminate style, unilocular, but showing on the walls of the cell the rudiments of the dissepiments of three cells; stigmas small, acute, connivent; ovules 3, basilar, erect, anatropous. *Fruit* globose or turbinate, covered with imbricating scales; mesocarp suberose or spongy; endocarp very thin pellicular. *Seed* solitary, globose, erect in the cavity; has the hilum basal, orbicular or elliptical; is enveloped with an integument more or less developed and at times abundant and fleshy, penetrating deeply above in correspondence

to the chalaza, into the substance of the albumen, which presents in that place a deep suborbicular cavity; the surface of the seed, divested of the integument, is even, and not pitted; the albumen is homogenous, bony, and, in a vertical section through the embryo, horse-shoe shaped; embryo basal.

Metroxylon is a very natural genus, not allied to any other, and well characterized by its arboreous habit, by the terminal definite inflorescence, and by the flowers in pairs, monœcious, externally similar, and densely arranged in cylindrical spikes. Its nearest ally may be considered to be the calamoid genus *Korthalsia*, which has also the flowers similarly approximate in spikes, but solitary, and really hermaphrodite, at the axilla of every spathel or bract; whereas in *Metroxylon* the flowers, although similarly placed, are in pairs and collateral, one of each being a male and the other a female or seeming hermaphrodite. With *Pigafetta*, *Metroxylon* has in common only the arborescent habit, for the first is a dioecious plant, with flowers quite different in the two sexes, and, on the whole, widely different from those of *Metroxylon*.

H. Wendland in the erroneous belief that *Metroxylon* had a seed provided with ruminate albumen, a belief caused by the false representation of the seed of *Sagus genuina* Labill in Turpin's "Dictionnaire des Sciences naturelles, Botanique" proposed the genus *Coelococcus* for *Sagus vitiensis*, which has indeed a seed with homogeneous albumen, excavate in its upper part, but which in no way differs from that of the typical *Metroxylons*. There is therefore no reason for keeping *Cœlococcus* distinct as a genus from *Metroxylon*. (About the rumination of the seed of *Metroxylon*, see my observations under *M. Rumphii* var. *buruensis*).

The fruit of *Metroxylon* contains normally only one seed; once, however, I found 2 seeds in M. *squarrosum* var. *Kilkarua*.

The two best known species of *Metroxylon*, *M. Rumphii* and *M. Sagus*, which indeed are barely distinct as species, present numerous varieties growing wild, but more frequently cultivated, in the Moluccas, and especially in Amboina and in Ceram. At my request, principally with the intention of obtaining a precise identification of the varieties of *Sagus* described by Rumphius, the authorities of the Botanic Garden of Buitenzorg have most kindly procured me specimens of numerous varieties of Sago palms growing in the Moluccas, and specially in Ceram. Notwithstanding this valuable help, I have not succeeded in identifying with certainty all the varieties mentioned in the "Herbarium Amboinese," or in giving precise characters for the new ones; such difficulty, however, is always encountered with species that have been long in cultivation, and have produced numerous varieties.

I have made an accurate study of the different species of *Metroxylon*, and especially of *M. Rumphii*, and have consequently been able to give a description more complete of that important genus than any yet published, and to make corrections of several gross errors, which have been traditionally transmitted from one author to another; such corrections more especially are that *Metroxylon* has a seed with homogeneous, and not ruminate albumen; that the flowers are not polygamous, nor hermaphrodite, but monœcious and proterandrous on the same spike, viz., that the female flowers are apt to be impollinated after all the male flowers have disappeared, and finally, as I have already demonstrated above, that there is no reason to consider *Cœlococcus* as distinct from *Metroxylon*.

IDENTIFICATION OF THE METROXYLON MENTIONED IN THE "HERBARIUM AMBOINENSE."

In regard to the identification of the forms of Sago palm described by Rumphius, it is necessary to bear in mind that we must not attribute an absolute value to the indigenous names by which in Rumph's work the different varieties are distinguished, as not only may these names vary from one locality to another, but also according to the person giving the information. Nevertheless I think the identification of *Sagus genuina* with *M. Rumphii*; of *Sagus lævis* with *M. læve*; and of *Sagus duri rottang* with *M. Rumphii*, var. *micracanthum*, is assured.

Sagus sylvestris is to all appearance a simple variety of *M. Rumphii*, less altered by culture than the latter.

The identification of *Sagus longispina* (*M. longispinum* Mart.) to which Rumph applies the native name "Lapia Macanaru," and which is said to produce a fruit as big as a hen's egg, is not certain, because a form with the name of "Sagu Macanaro," was sent to me with small fruits, similar to those of *M. Rumphii* var. *micracanthum*; nevertheless, I consider *Sagus longispina* as only a variety of *M. Rumphii*, producing fruits larger than usual, but not much larger than those represented in my plate 105.

RUMPH'S VARIETIES OF SAGUS.

1. Sagus genuina—Native name "Lapia Tuni" = *Metroxylon Rumphii*.*
2. „ silvestris—Native names "Lapia Ihur" and "Ihul" = *M. Rumphii* VAR. *sylvestre*.†
3. „ longispina—Native names "Lapia Macanaru," "Macanalo" or "Macalanum" = *M. Rumphii* VAR. *longispinum* Becc. (M. longispinum Mart.)‡
4. „ lævis—Native name—"Lapia molat" = *M. Sagus*.§
5. „ duri rottang—Native name—"Lapia Luli—uwe" = *M. Rumphii* VAR micracanthum. ||

GEOGRAPHICAL DISTRIBUTION.

The more common and better known species of Sago Palms, *Metroxylon Rumphii* and *M. Sagus*, and their numerous varieties, are littoral plants, growing in low-lying and swampy places, and planted for the sake of the large amount of starch obtainable from their trunks. The above-mentioned species, easily reproduced by off-shoots, are spread out and more or less intensely cultivated from the Malay Peninsula to the Philippines, in the Malay Islands, in the Moluccas, in New-Guinea and in the Aru Islands, wherever suitable conditions of soil for their development exist, as they afford one of the most important articles of food to many native populations. The place of origin, however, of the two above-mentioned species is most probably to be looked for in the Moluccas, and especially in Ceram, where, besides the usual forms of *Metroxylon* with numerous varieties, common especially on its western and southern shores, there grows in abundance, at its eastern end, a distinct, and hitherto undescribed species (*M. squarrosum*).

* With the name of "Sagu Tuni" I have received fruits of *M. Rumphii* VAR. *micracanthum*.

† The fruits received with the name of "Sagu Ihor" really agree with Rumph's plant.

‡ With the name of "Sagu Makanaru" I have received the sub-variety *Makanaro* of *M. Rumphii* VAR. *micracanthum*.

§ The fruits received with the name of "Sagu Malat" or "Molat" agree with those of Rumph's *Sagus lævis*, only are a little smaller.

|| Received with the name of "Sagu Tuni."

Forms of *Metroxylon* to be considered as varieties, or sub-species, of *M. Rumphii* and of *M. Sagus* are *M. Sagus* VAR. *gogolensis*, and *M. Sagus* VAR. *Peekelianum*; these take the place of the Malayan varieties in Kaiser Wilhelm Land on the North Coast of New-Guinea.

One fruit of *Metroxylon* referable also to a variety of *M. Rumphii*, or of *M. Sagus*, was collected by L. M. D'Albertis on the Fly River, in the south part of New-Guinea, demonstrating that the genus *Metroxylon* is represented in the littoral regions of the two opposite extreme ends of the great island.

Not all the species of *Metroxylon* flourish in low swampy land near the sea shores, as several thrive best inland on the hill slopes, and in dry situations; these are mainly species referable to the section *Cœlococcus*, and inhabitants of the Polynesian Islands, where they represent one of the most remarkable elements of their flora; in this category are *M. vitiense* in Fiji; *M. salomonense* in the Salomon Islands, and *M. Amicarum* in the Carolinas.

I do not know the distribution limits of *M. Warburgii*, a native of the New Hebrides, nor of *M. upoluense* of Samoa.

M. bougainvillense appears from a photograph taken by Dr. Rechinger to be a plant of the strand Flora in Bougainville Island. On the main land of German New Guinea and in the neighbouring New Ireland there also grows a *Metroxylon*, apparently not differing from *M. salomonense*.

In Ceram several varieties of *Metroxylon* are referable to *M. Rumphii* and *M. Sagus*, frequently cultivated, or semi-wild, in its West and Central parts, while in the Eastern end the new species *M. squarrosum*, mentioned above, abounds. The natives distinguish the following varieties of this last species:—Kilwoi—Killasi—Kikaruwa—Kilatan—Kilkow—Kiltafook—Kilkikir.

The varieties from the central and southern coasts of Ceram (Amahai) are—

1.	Sagu Malat	= *M. Sagus*		VAR.	*Malat.*	
2.	,, merah	= *M. Rumphii*		VAR.	*ceramense*	*rubrum.*
3.	,, puttih	= *M.*	,,	VAR.	,,	*album.*
4.	,, hitam	= *M.*	,,	VAR.	,,	*nigrum.*
5.	,, Ceram	= *M.*	,,	VAR.	*platyphyllum.*	

Of each of these varieties I have received from Buitenzorg only one fruit and one leaflet, which is too little for a sure identification. The "Sagu Malat" is without spines, and accordingly is referable apparently to *M. Sagus*; the other 4 are indicated as being spinous, and have large leaflets, and fruits smaller than those of *M. Rumphii* (type), but larger than those of M. *Rumphii* VAR. *micracanthum.*

From the West end of Ceram are—

1.	Sagu Molat	= *M. Sagus*	VAR.	*molat.*
2.	,, Ihor	= *M. Rumphii*	VAR.	*sylvestre.*
3.	,, Rottan	= *M.* ,,	VAR.	*Rotang* SUB-VAR. *Makanaro.*
4.	,, Makanaro	= *M.* ,,	VAR.	*micracanthum.*
5.	,, Tuni	= *M.* ,,	VAR.	*micracanthum.*
6.	,, puttih	= *M.* ,,	VAR.	*ceramense album.*

The "Sagu molat" is without spines, and corresponds to that bearing nearly the same name (malat) from Amahai; all the others are referable to M. *Rumphii*; of these "Sagu Tuni" (var. *micracanthum*) differs from the type more than the others, by its very small fruits, but "Sagu Makanaro" (which I have also reduced to var. *micracanthum*) forms a transition to the varieties with larger fruits. The "Sagu puttih" of West Ceram slightly differs from the "Sagu puttih" of Amahai.

METROXYLON.

Key to the Species.

A.—Eumetroxylon.—*Fruit clothed with scales in 18 vertical series.*

I.—Spikes of tomentose appearance, having the pedicellar part convex on the outer side, and flat on the axial side, and its margins sharp and densely woolly at the base.

* Leaf-sheaths, petiole and spathes, primary and secondary, without spines.

Fruit globular-depressed, broader than high, 4 cm. across, 30—34 mm. high, upper and lower surfaces slightly concave.

1. M. Sagus Rottb. (forma typica).—Malay Isl., etc.

Fruit globular, rounded above, excavate at the base smaller than in forma typica (28 mm. in diam.).

1a. M. Sagus var. **Molat** Becc.—Ceram.

Fruit small, globular, slightly longer than broad, 20—23 mm. long, 20—22 mm. broad; Scales having discoloured margins not quite ½ mm. wide.

1b. M. Sagus var. **Peekelianum** Becc. —German New-Guinea.

Fruit very small, spherical, 16—18 mm. in diam., scales having relatively large discoloured margins (nearly 1 mm.).

1c. M. Sagus var. **gogolense** Becc.—German New-Guinea.

** Leaf-sheaths petioles and primary spathes spinous (secondary spathes at times smooth ?).

Fruit relatively large, globular, slightly longer than broad, 4·5 cm. across; petioles strongly spinous, mid-costa of the leaflets slightly spinulous.

2. M. Rumphii Mart. (forma typica)—Malay Islands.

Fruit slightly smaller than in 2; petiole armed with shorter spines.

2a. M. Rumphii var. **Rotang** Becc.—West Ceram.

Fruit larger than in 2; petiole armed with few and very long spines.

2b. *M. Rumphii* VAR. ***longispinum*** Becc. Amboina.

Fruit globular-depressed, smaller than in type. 30—35 mm. high, 35—38 mm. across; leaflets with long bristles on the mid-costa (always ?).

2c. *M. Rumphii* VAR. ***sylvestre*** Becc.—West Ceram.

Fruit of middling size, globular or oblong (not depressed), smaller than that of *M. Sagus*, and larger than that of var. *micracanthum*. Leaflets large and broad.

2d. *M. Rumphii* VAR. ***ceramense*** Becc.—Ceram.

Fruit ovoid-oblong (always ?) 37 mm. long, 26 mm. high. Leaflets very large 12 cm. and over wide.

2d'. *M. Rumphii* VAR. ***ceramense*** SUB-VAR. ***platyphyllum.***—Amahai (Ceram).

Fruit oblong, 3 cm. long, 22 mm. broad.

2d''. *M. Rumphii* VAR. ***ceramense*** SUB-VAR. ***rubrum*** Becc.—Amahai (Ceram).

Fruit globular, rounded above, the base excavate, 32 mm. in diam.

2d'''. *M. Rumphii* VAR. ***ceramense*** SUB-VAR. ***album*** Becc.—Amahai (Ceram).

Fruit globular, rounded above, slightly smaller than in d'', 3 cm. in diam.

2d'''' *M. Rumphii* VAR. ***ceramense,*** SUBVAR. ***nigrum.***—Becc.—Amahai (Ceram).

Fruit very small, globular or very slightly obovoid, not depressed above, acutely beaked; pericarp thin above, thick and spongy at the base.

2e *M. Rumphii* VAR. ***micracanthum***—Becc.—Ceram.

Fruit 23 mm. in diam.

2e' *M. Rumphii* VAR. ***micracanthum*** SUBVAR. ***Tuni.***—West Ceram.

Fruit 27—28 mm. in diam.

2e'' *M. Rumphii* VAR. ***micracanthum*** SUBVAR. ***Makanaro.***—West Ceram.

Fruit very small, spherical, 18—20 mm. in diam. (not certain if the secondary spathes are spinous or smooth).

2f. *M. Rumphii* VAR. ***buruens*** Becc. Buru.

Fruit rather large, flat and broad above, slightly attenuate at the base, 4 cm. long, 33 mm. through.

2g. M. Rumphii VAR. **fiyriverense** Becc.—New Guinea, Fly River.

II. Spikes of glabrous and squarrose appearance and having the pedicellar part flattened, and with obtuse quite glabrous margins.

3. M. squarrosum Becc.—East Ceram.*

B—COELOCOCCUS.—*Fruit, clothed with scales in 24—29 vertical series.*

* Fruit more or less attenuate to the base, obpyriform or turbinate; the seed placed in its upper and broader part, the lower and narrower part being spongy inside.

Fruit 10—12 cm. long, 7—9 cm. across in its upper part. Scales in 24 vertical series. Leaflets glaucous beneath.

4. M. Warburgii Heim.—New Hebrides.

Fruit very small, obpyriform, attenuate to a narrow base, 33 mm. long, 25 mm. broad in its upper part. Scales in 24 vertical series.

5. M. upoluense Becc.—Upolu in Samoa.

** Fruit globular or ovoid.

Fruit round at the base, and broadly conical above, 5·5—6·5 cm. long 4·5—7 cm. broad.

6. M. vitiense Benth. et Hook.—Fiji Islands.

*** Fruit globose or more or less depressed.

† Fruit very large, 8 cm. in diam. and more, flattish on the top, and not excavate at the base; having short bluntish tips.

7. M. amicarum Becc.—Caroline Islands.

(*a*) Flowers 8—8·5 mm. long, 3·5—4 mm. broad. Fruit slightly broader than high, 8—9 cm. in diam.

M. amicarum—VAR. **commune** Becc.

(*b*) Flowers 12 mm. long, 5—6 mm. broad. Fruit 11—13 cm. in diam.

M. amicarum VAR. **Maius** Becc.

* Referable to this species are the varieties received from Buitenzorg with the following native name and notes:

a. Kilwoi.—No spines; petioles intensely green.

b. Killasi.—No spines; petioles of a gray colour.

c. Kilkarua.—From base to top (the trunk? leaf-bases?) covered with long and thick spines. The petioles intensely green.

d. Kilatan o Kilatankirkio.—Spines short and thick, petioles long.

e. Kilkour.—From base to top (the trunk?—leaf-bases?) covered with moderately large spines Trunk and branches (petioles?) white.

f. Kiltafuk.—From base to top (the trunk?—leaf-bases?) covered with slender and moderately long spines; petioles green.

g. Kilkikir.—The trunk (leaf-bases?) without spines; the petioles covered with dense tufts of short spines.

†† Fruit 7 cm. in diam. or thereabouts, globular-depressed, not excavate at the base; seed 4 cm. in diam.; pericarp 5—6 mm. thick; scales with produced acute tips.

8. M. salomonense Becc.—Solomon Islands German New-Guinea and New Britain.

††† Fruit 5·5 cm. in diam.; globular-depressed; the base excavate; pericarp 10—12 mm. thick; scales with produced acute tips; seed 2·5 cm. in diam.

9. M. bougainvillense Becc.—Bougainville E Island.

Description of Plate V.

Figs. 1—7. Metroxylon amicarum commune *Becc.*—Fig. 1. Full grown flower bud.—Fig. 2. Female (hermaphrodite) flower during the anthesis.—Fig. 3. Female (hermaphrodite) flower from which one of its divisions has been cut off showing the ovary entire and *in situ.*—Fig. 4. Longitudinal section of a male flower.—Fig. 5. Spathel showing its lower surface, and shielding one pair of flowers (♂ and ♀)—Fig. 6. Spathel showing its upper side (*a*, *a*) and the floral bracteoles above it united (*b*, *b*) and furnished, right and left, with a falcate tuft of paleaceous hairs, their respective flowers having been removed. All figures enlarged 7 diameters.—Fig. 7. Diagram of a spathel with the relative flowers and bracteoles.

Figs. 8—12. Metroxylon Warburgii *Becc.*—Figs. 8—9. Female (hermaphrodite) flower buds, enlarged 4 diameters.—Fig. 10. Female flower bud cut open longitudinally, showing the ovary entire, and *in situ.*—Fig. 11. Another female flower bud cut open longitudinally, the ovary having been removed. (Figs. 10—11 enlarged 7 diameter.)—Fig. 12. Diagram of a spathel with its relative flowers, and bracteoles.

Description of Plate VI—A.

Figs. 1—8. Metroxylon Rumphii *Mart.*—Fig. 1. Transverse section (semi-schematic) of a spike showing the spathels united by their margins, and the insertion of the two flowers (♂ and ♀) for which purpose their woolly bracteoles have been removed.—Figs. 2—3. Flower buds.—Fig. 4. Female flower bud cut open, having one of the divisions of the corolla removed to show the ovary entire *in situ.*—Fig. 5. Male flower bud of which two of the divisions of the corolla have been removed, showing the androecium entire.—Fig. 6. Male flower bud cut open, having one-third of the corolla removed and showing at its base the rudiments of the ovary.—Fig. 7. Longitudinal section of a growing ovary.—Fig. 8. Diagram of the spathel with the relative flowers and bracteoles. (Figs. 1—3 enlarged 5 diam.; figs. 4—7 enlarged 7 diam.)

Figs. 9—11. Metroxylon Sagus *Rottb.*—Fig. 9. Vertical section of a seed normally evolute.—Fig. 10. Vertical section of a seed in which the embryo passes through the entire wall of the albumen into the chalazal cavity.—Fig. 11. Vertical section of a seed having the albumen completely perforated by the intrusions of the integument. All figures of natural size.

Figs. 12—14. Metroxylon squarrosum *Becc.*—Figs. 12—13. Two flower buds, enlarged 7 diameters.—Fig. 14. Vertical section of a seed (nat. size).

Fig. 15. Metroxylon Rumphii VAR. buruense *Becc.*—Vertical section of a seed from one of the fruits of *Sagus genuina* collected by Labillardiere in Buru, after it had been softened by boiling (Nat. size).

Fig. 16. Metroxylon salomonense *Becc.*—Vertical section of a seed, from Rechinger's collections in New-Guinea (nat. size).

Fig. 17. Metroxylon bougainvillense *Becc.*—Vertical section of a seed, from an immature fruit after it had been softened by boiling. From Rechinger's collections in Bougainville Island.

Descriptions of Species.

1. METROXYLON SAGUS Rottböl in Nye Saml. K. Danskel Vidensk. Schrift. ii, 527, t. 1; Miq. Fl. Ind. Bat. iii, 147; Becc. in Nuovo Giorn. Bot. Ital. iii. 29 and in Denkschriften der K. Akad. d. Wissensch. math. naturw. Kl. Wien, lxxxiv, (1913) 62, f. 6; Hook. f. Fl. Brit Ind. vi, 481.

M. inerme Mart. Hist. Nat. Palm. iii, 215.

M. laeve Mart. l. c. 214.

M. hermaphroditum Hassk. in Tijdschr. Nat. Geschied. ix, 175 and Cat. Bogor. 65.

Sagus lævis Rumph. Herb. Amb. i, 76; Blume Rumphia, ii, 147, t. 86, 126, 127 (*Sagus Rumphii*); Griff. in Calc. Journ. Nat. Hist. v, and 20, Palms Brit. Ind. 24 (not t. CLXXXII).

Sagus Kœnigii Griff. l. c. 22 t. CLXXXI.

Sagus inermis Roxb. Fl. Ind. iii, 623.

Sagus genuina δ lævis Giseke, Prol. in Ord. Nat 94.

DESCRIPTION.—(*Forma typica*)—Not differing in general aspect from *M. Rumphii* hereafter described, but with *leaves* (leaf sheaths, petiole and rhachis) and spathes, primary and secondary not spinous. *Leaflets* linear-ensiform, the mesials and largest of the full grown plants, 1·5 m. long, and 8 cm. wide or thereabouts, very gradually acuminate above to a slender and at times filiferous tip; the mid-costa very strong, acute and smooth on the upper surface or only very slightly spinulous near the apex, underneath furnished with a continuous line of chaffy scales; the margins smooth or with a few rudimentary spinules; the upper leaflets gradually curtailed, less acuminate, and with rigid tips (apparently only the lower leaflets have the apex filiferous). *Spadices* exactly as in *M. Rumphii*, but having all the spathels (primary and secondary) quite spineless. *Spikes* 10—13 cm. long, and 12—13 mm. in diameter (when the flowers have fallen), or a little more slender than those of *M. Rumphii*; when old, and without flowers the spikes are of a less tomentose appearance, having the spathels a little more produced beyond the villosity of the floral bracteoles than in *M. Rumphii*. *Male* and *female* full grown *flower buds* 6—7 mm. long,

obovoid-oblong, slightly narrowing above, but obtuse at apex; the calyx tapers below to a narrow base, is 3-lobed, the lobes broad rounded at apex, and finely striately-veined externally; in the female flower the calyx later splits into 3 parts; on the whole both kinds of flowers are very much like those of *M. Rumphii*, but have, perhaps, the calyx less deeply 3-lobed, and more distinctly striately-veined. The *fruit* is globular, slightly depressed, looks like a small wild apple, is always somewhat broader than high, 4 cm. in diameter, and 30—34 mm. high, has the upper and lower face equally and slightly concave, but the lower umbilicate and the upper acutely mucronate; the pericarp is of an average thickness of 6 mm. in the fresh fruit, having the mesocarp spongy and succulent, but reduced uniformly all round, even at the base, to 3 mm. in the dry state; the endocarp is very thinly membranous; on the walls of the smooth endocarpal cavity are plainly visible the traces of the 3 rudimentary dissepiments and exactly at the bottom of the cavity are the remains of two abortive ovules, as always only one ovule is developed into seed. The *seed* completely fills the cavity, and has the form of the entire fruit, is globular-depressed, and when fresh is 28—30 mm. in diameter; it is attached to the bottom of the cavity by means of a circular hilum of the diameter of about 6 mm.; in the fresh fruit the seed is enveloped in a thick fleshy integumentum, adherent to the nucleus, and having the outer surface shiny and slightly marked by the impression of the irregularity of the internal cavity of the pericarp; the integument penetrates into a large orbicular cavity corresponding to the chalaza in the upper part of the nucleus. In the dry fruit the integument is thickly crustaceous and brittle; the nucleus is entirely formed by the albumen 20—24 mm. in diameter, has the chalazal cavity 7—8 mm. in diameter, and is rounded below; the albumen is white, bony, and in a vertical section through the embryo is horse-shoe shaped, with the sides 6—7 mm. thick; the embryo is basal, at times slightly remote from the hilum, and traverses almost the entire base of the albumen. The scales are in 18 vertical series, rhomboidal, the mesials 12 mm. broad, shiny and straw-coloured when dry, slightly darker near the margins, somewhat convex, deeply grooved along the centre; the apices triangular, slightly produced, bluntish or subacute; the margins very narrowly discoloured or scarious and finely erosely-toothed.

In some fruits (received from the Botanic Garden of Buitenzorg) the seed is completely perforated by the intrusion of the integument, or in other words the orbicular upper chalazal cavity is connected with the lower surface of the seed, in proximity to the embryo, by a channel filled with the same substance as exists in the upper cavity, exactly as occurs in the seed of the species of *Thrinax* of the sectio *Porothrinax*. Further I have observed in certain seeds some slight, peripherical intrusion of the integument into the substance of the albumen, denoting a commencement of rumination.

Habitat.—It is cultivated like *M. Rumphii*, and in some countries even more than that species, especially in the entire group of the Moluccas and in Borneo. In Borneo it is very extensively cultivated in Sarawak at the mouths of the Rivers Oja, Muka, Bintulu, Kalaka, etc. I have seen specimens of it from Sumatra (Padang—*Beccari*) from Java, from the Malay Peninsula, and from the Philippines

(*Loher* in Kew Herbarium). I have not met with it in Dutch New-Guinea. It is also cultivated in Malacca (*Griff.*)

Observations.—The species is easily distinguishable from *M. Rumphii* by its non-spinous leaves and spathes; the secondary spathes or spathes of the spike-bearing branches are also smooth and not covered with small spines, as is the case in *M. Rumphii.* The most characteristic forms of *M. Sagus* are also distinguishable from *M. Rumphii* by their fruits globular depressed or broader than high; the spikes also are more slender, have a less tomentose appearance, for the spathels project more than in *M. Rumphii* above the villosity of the flower bracteoles; the flowers have the calyx less deeply 3-lobed, and more distinctly striately-veined. On the whole, however, it is a species very closely related to *M. Rumphii*, and I am not sure that all the differences I have mentioned are always to be considered as reliable diagnostic characters, the absence of spines on leaves and spathes excepted; even the spinescence is probably a character of little diagnostic value, as it often happens in other Palms, in *Calamus* for instance, that some specimens identical in all the reproductive organs, have the leaf-sheaths sometimes densely covered with spines and at other times smooth; further *Metroxylon squarrosum* occurs with both spinescent and smooth leaves, all the other characters being the same.

M. Sagus yields the flour or Farina of Sago, and the well-known granulated starch exactly as *M. Rumphii*, and like that affords numerous other commodities to the natives.

M. Sagus certainly corresponds to *Sagus lævis* of Rumph, of which he writes that it receives in Amboina the name of "Lapia molat", and that it produces an excellent kind of flour, with which the Amboinese make their much esteemed dense gruel named "Papeda" and a kind of bread; biscuits of general use are also made by cooking the flour in small heated stone moulds.

It is the "Rambia" of the Malays of Java and Sumatra. "Kirai" is its Javanese name; and it is known now in Amboina as the "Sagu perampuan" (the female Sagu) or the "Sagu papeda" (the Gruel Sagu).

Plate 104.—Metroxylon Sagus *Rottb.*—Spike-bearing branch with mature fruits; fruits entire, and in vertical section. In the lower part of the plate one figure shows a vertical section of a seed normally evolute; in another figure, the embryo traverses the entire albumen, and with its apex attains the internal cavity; in a third the seed appears completely traversed by the integument, and shows also traces of rumination. Intermediate segment from a full grown plant. Specimen from a plant cultivated at Buitenzorg (Herb. Becc.).

Plate 106.—Metroxylon Sagus *Rottb.* (The group of figures in the lower part, and on the left side of the plate only).—Fruits collected by me at Padang in Sumatra. One is transversely cut, leaving entire the seed, which shows its lower part with the hilum, and the relics of the two abortive ovules; another figure represents the bottom of the endocarpal cavity of the preceding figure, and shows the insertion of the seed, the traces of the abortive ovules, and of the absorbed dissepiments. The two halves of one seed, cut vertically through the embryo. From specimens in alcohol.

1a. Metroxylon Sagus var. Molat Becc.

Description.—Petiole and rhachis unarmed; a *leaflet* is 1·60 m. long, and 9 cm. wide, the margins spinulous only near the apex, otherwise smooth, very long-acuminate to a slender tail like tip, the mid-costa spinulous only near the apex. *Fruit* globose, not depressed, 25—29 mm. in diameter with rounded and mucronate top; the base slightly excavate; scales slightly larger than long, deeply grooved along the centre, the largest 9—10 mm. broad in the exposed part.

Habitat.—Ceram in the West end, and at Hamahai on the south coast of the central part of the Island. Received with the native name of "Sagu molat" or "S. malat." This is the name that Rumph attributes to his *Sagus lævis*, corresponding to *M. Sagus*, from which the present variety differs only in having a somewhat smaller and more roundish fruit.

Two fruits from W. Ceram are 25—29 mm. in diameter; one from Amahai is 28 mm.

Plate 107.—Figs. 7-8—Metroxylon Rumphii var. Molat *Becc.*—Fig. 7, two fruits from W. Ceram; fig. 8 one fruit from Amahai.

1b. Metroxylon Sagus var. Peekelianum Becc. new var.

Description.—Not differing in habit from *M. Sagus*; 8—10 m. high; the trunk very stout (Peekel). *Leaves* having quite smooth petiole and rhachis. *Leaflets* with mid-costa and margins smooth, very long-acuminate, those of the lower part of the rhachis terminating in a filament 6—7 cm. long, not ciliate, nor spinulous. Spike-bearing branches 50 cm. long (in one specimen) bearing 5 spikes on each side; spathes unarmed, covered, especially in their upper part, with pale appressed small scarious scales. *Spikes* of tomentose appearance, the apices of the spathels slightly protruding beyond the wool of the flower bracteoles; their pedicellar part is concave on the axial side and has the margins very sharp and densely tomentose. The *fruits* are spherical or a trifle longer than broad, 20—23 mm. long, 20—22 mm. broad, not narrowing to the base, which is slightly hollowed; the apex is umbilicate, and shortly beaked; scales narrowly and not deeply grooved along the centre, glossy, straw coloured, with a rather conspicuous darker intramarginal line, the margins narrowly discoloured; less than ·5 mm. wide (or much less than in vas. *gogolensis*) and finely erose-toothed; the apices triangular, not produced, and blunt. The pericarp is thin in the upper part, and thicker at the base from the more copious spongy mesocarp.

Habitat.—German New-Guinea at Namatanai near Salsal in New-Mecklenburg in swampy places (*Peekel* No. 115 in Berlin Herbarium); native name "A bia tun." Curiously enough, this name seems to correspond to that of "Lapia Tuni" under which, according to Rumph *M. Rumphii* is known in Amboina.

Observations.—Distinguishable from *M. Sagus* (*forma typica*) by its much smaller fruits, and by the spathes of the spike-bearing branches being covered with

appressed scarious scales. From variety *gogolense* it differs by the larger fruits, which also have the scales with narrower discoloured margins.

PLATE 106.—Metroxylon Sagus VAR. Peekelianum *Becc.* (The figures on the left side on the upper part of the plate only.) Spike and 3 fruits in different aspects; from Peekel's No. 115 in the Berlin Herbarium.

1c. METROXYLON SAGUS var. GOGOLENSE Becc.

M. *lœve* (non Mart.) Schum. and Lauterb. Fl. Deut. Schützg. in der Sudsee (1901) 202 (partly?).

DESCRIPTION.—The *leaves*, in those parts seen by me, are not spinescent. The *leaflets* are indistinguishable from those of *forma typica*; those seen are a little over 1 m. in length, and 7·5 cm. wide; the mid-costa has a few scales underneath and is spinulous above in its upper third as are also the margins. The spike-bearing branches, which are exactly the same as in *forma typica*, have the spathes unarmed and covered with a thin greyish coating in their upper part. The spikes have a tomentose appearance from the tips of the spathels, which protrude somewhat above the wool of the flower bracteoles, are 9—10 cm. long, and 11 mm. in diameter; their pedicellar part is concave on the axial side, with the margins sharp, almost winged and is densely tomentose, especially at the base. The *fruits*, which although not thoroughly mature in the specimens seen by me, had none the less attained their definitive size, are the smallest of all known species or varieties of *Metroxylon*, are globular, 16—18 mm. in diameter, a little broader above than at the base which is round and not in the least excavate, are flattish, or slightly depressed on the top and suddenly beaked; the beak is narrow, acute, sulcate, 2 mm. long; scales small, the largest 4 mm. wide in the exposed part, their apices triangular, not produced, rather broadly grooved along the centre and of a pale straw colour, have a slightly darker intramarginal line, and the edges represented by a scarious, discoloured greyish and relatively broad (nearly 1 mm. wide) band; the extreme margins are minutely erose-toothed. The whole pericarp is uniformly about 2 mm. thick.

HABITAT.—German New-Guinea; on the lower course of the Gogol River, collected by *Lauterbach*, the 4th November 1890 (No. 861 in Berlin Herbarium).

OBSERVATIONS.—I have considered this *Metroxylon* as a variety of *M. Sagus*, but it is not known if the bases of the leaves and the petioles are smooth or spinescent; in any case it is a very distinct variety if not of *M. Sagus*, then of *M. Rumphii*, or perhaps a subspecies of one of these, distinguishable by its very small fruits and scales having a broad discoloured edge. It is the *Metroxylon* with the smallest fruit known; on this account it approaches *M. Rumphii* VAR. *buruense*, but in the latter the scales have a very narrow scarious margin and the pericarp is relatively thick and spongy, whereas the pericarp is uniformly thin all round in VAR. *gogolense*.

PLATE 106.—Metroxylon Sagus VAR. gogolense *Becc.* (The figures on the right hand side on the upper part of the plate only). A spike, and three fruits entire, in different aspects; one fruit in vertical section, the seed *in situ* entire; from Lauterbach's No. 861 in the Berlin Herbarium.

2. Metroxylon Rumphii Mart. Hist. Nat. Palm. iii, 214 (2nd edit.) and 313 t. 102. 159; Miq. Fl. Ind. Bat. 140; Becc. in Nuovo Giorn. bot. Ital. iii, 30: Malesia i, 91; Hook. F. Fl. Brit. Ind. vi, 481.

Sagus Rumphii Willd. Sp.Pl. iv, 404.

Sagus genuina Rumph. Herb. Amb. i, 75. t. 17 18 (excl. *Sagou duri rottang*); Blume, Rumphia ii, 150.

Sagus spinosus (*Lapia tuni* or *genuine Sago-tree* of Rumphius) Roxb. Fl. Ind. iii, 623 excl. syn.

Description.—(Forma typica). Gregarious and sending forth many basal offshoots. The *trunk* in young vigorous plants is entirely clothed with leaves, the base of which is much enlarged, sheathing and spinous; the petiole is also armed with long spines. The full grown plants, approaching the emission of the inflorescence, have a stout columnar straight trunk, about 60 cm. in diameter, attaining 8—10 m. in height, irregularly ringed with the scars of fallen leaves, the bases of which remain long attached to the trunk, which otherwise is quite smooth. The trunk has a narrow outer hard woody-fibrous zone, and internally is spongy and succulent and mainly formed of cells filled with starch. *Leaves* about 7 m. long, imbricately inserted and ascendent, the lower oldest reflexed; the very large embracing bases of the leaves are glaucous—green 1—1.Lm. long, and about 45 cm. wide at the base, are firmly coriaceous, deeply and broadly concave inside, convex externally, have thin margins soon withered, and are armed externally with several transverse pectinate series of unequal, flattened spines 3—4 cm. long or less, confluent by their bases; the petiolar part is about as long as the sheath and much longer in leaves of young and robust plants; it is 15 cm. thick, broadly channelled above, rounded beneath, polished externally of a soft and pithy structure inside and hard at the periphery, armed all along the dorsum, but especially in its lower portion with small series or fascicles of digitate unequally flattened or needle-like spines, some of which attain 7—8 cm. in length, and are still longer in leaves of young plants. Rhachis rounded below and similarly armed as the petiole, especially along the centre, but with the spines becoming gradually less numerous and feebler towards the apex; the intermediate portion of the rhachis is bifaced above and has the salient angle smooth, and not very sharp. *Leaflets* inserted transversely at an angle of 45°, numerous and equidistant, the mesial being 6—7 cm. apart on each side, are rigid-papyraceous, green and shiny on both surfaces, very faintly paler beneath, straight, broadly linear-ensiform, somewhat narrowing, and having reduplicate margins at the base, gradually long-acuminate towards the apex, which in the lower and intermediate leaflets is lengthened out to a filiform caudiculum, several centimeters long, becoming obsolete in the upper leaflets; the margins are acute (not thickened by a marginal nerve) and furnished with small spinules distant at the base but becoming closer and stronger and more spreading towards the apex; the mid-costa is very robust, prominent and acute on the upper surface, where it is more or less spinulous only near the apex; underneath it is slender, and furnished, especially near the base, with a line, at times continuous, of brown ramentaceous scales, apparently deciduous by age; otherwise the lower surface is quite smooth, glabrous, and without

dots (microlepidia); on each side of the mid-costa are 2—3 secondary nerves, not very distinct, but marked on the upper surface by faint furrows; tertiary nerves rather numerous, slender; transverse veinlets very numerous, much interrupted, not always sharply distinct. The intermediate and largest leaflets are 1—1·20 m. long, and in their broadest part, at about their middle, 6—8 cm. wide; the upper leaflets speedily become considerably smaller; the lower leaflets are smaller than the mesials, and have the apex more lengthily filamentose. *Inflorescence* terminal, very large, composed of several partial inflorescences, each sprouting from the axilla of one of the uppermost leaves, which, however, when the fruits are mature, perish with the entire plant. The partial inflorescences are 1·5 to 2·50 and more metres long, simply branched, since the first divisions of the main axis carry the spikes; an entire partial inflorescence which I measured was 2·60 m. long, including its peduncular or unbranched part; the latter was a little below 1 m. in length, arched outwards, subterete or slightly flattened, 6 cm. in diameter at its base, 4 cm. above, clothed with several coriaceous spathes, tubular and closely sheathing in their lower part, obliquely spread open into an ass's ear—like blade above and having a triangular acuminate point; such spathes are furfuraceous and covered on their backs with horizontal series of confluent spinules, 5—10 mm. long; the entire axial part of the inflorescences gradually narrows above, and continues to be clothed with spathes, similar to those just described, but gradually smaller, each alternately shielding the base of a spike bearing branch; on the whole one entire partial inflorescence is composed of several (15 in one specimen) spike-bearing, arched, spreading branches, the lowest of which, being the largest, is 40—50 cm. long, and carries alternately on each side, 4—5 spikes; the branches terminate in a very short blunt point, formed by vacuous spathels; the spathes of the branches at the axillas from which spring the spikes, are 5 cm. long, rigid-papyraceous, cylindraceous, closely sheathing, unclosed along one side, gaping above, and terminating in a spreading usually lacerated and withered point, are glabrous and smooth in their lower part, and covered with very slender, scattered spinules above; the axial part of the branches at the base of every spathe is flat at one side, and is densely woolly on the margins. The spikes are supported by a pedicellar part about as long as their respective spathes and are inserted at the bottom of the latter; the pedicellar part is flat on the axial side, has the margins tomentose, and is sheathed in its upper half part by a special spathe which terminates in a triangular point embracing the base of the spike; the spike itself is provided at the base with 2—3 other gradually smaller spathes. *Spikes* cylindrical, 10—12 cm. long, obtuse, 15 mm. in diameter (not taking into account the flowers) and of a tomentose appearance, having the spathels very slightly exserted from the wool of the flower bracteoles; a transverse section of the spikes shows 3 broad reniform chestnut brown glabrous striately-veined spathels, more or less united at the base by their margins, and having a short triangular obtuse point; in the axilla of every spathel nestle two flowers, one of which is a male and the other a female or more correctly a semi-hermaphrodite. The special flower bracteoles are very small, very thinly membranous, brown, and completely disguised by the villosity that covers them, and in which the flowers are half immersed. The male and female flowers at a certain period of the development of the spadix, are nearly equally evolute on the same spike, perfectly equal and arranged with great regularity, following

easy spirals. The time of blooming, however, is different, the male flowers being precocious or opening and drooping before the female are ready for pollination ; in a second period therefore the spikes show only the female flowers, and spiral furrows indicate the spaces left empty by the fallen male flowers. The full-grown flower buds (male and female) are obovoid-oblong, obtuse at apex, and narrow somewhat at the base, are 6—7 mm. long and 3 mm. broad and have their lower half immersed in the villosity of the bracteoles. The calyx is more or less deeply 3-lobed, the lobes are subcoriaceous, half-ovate, obtuse, and faintly striately-veined externally ; the corolla is one-third or one-half longer than the calyx, and is divided in its upper two-thirds into 3 coriaceous concave boat-shaped segments, its lower third part being entire and campanulate. The *male flowers* are a little narrower than the female ; the stamens form with the united bases of the filaments an urceolum almost entirely connate with the undivided part of the corolla ; in the free part the filaments are broadly linear, flattened, truncate at the apex, but terminated by a very minute apiculum, to which are attached the anthers at about the middle of their backs ; the anthers are elongate-elliptical, obtuse, their cells are parallel and open laterally and are disjunct in their basal part. Rudimentary ovary represented by 3 small oblong bodies, arising from the bottom of the undivided part of the corolla. The *female flowers* have stamens similar to those of the male but the anthers are slightly smaller ; the calyx is more deeply 3-lobed, and finally 3-parted ; the ovary is obovoid-turbinate, abruptly narrowing into a thick style, which is deeply sulcate or stamped with the outlines of the anthers, and reaches, with its acute stigmatiferous apex, the summit of the anthers. *Fruit* globose, 4·5 cm. across usually a few millimeters longer than broad, more or less hollowed-umbilicate at the base, and flattish or slightly excavate and mucronulate above. Scales shiny, in 18 longitudinal series, regularly rhomboidal, almost as long as broad ; the mesials are 12—15 mm. wide, somewhat convex, and having a deep furrow, continuous along the centre in all the scales of the same series ; are of a dirty straw colour when dry and slightly darker near the margins ; the true marginant part of the scales is very narrowly scarious and discoloured, and very minutely erose-ciliolate ; the apices are slightly produced, appressed and bluntish. The *seed* is almost always abortive, even in fruits having a fully-developed pericarp ; when, however, the seed is normally evolute, it is undistinguishable from that of *M. Sagus.* The fruits either with abortive or with normally evolute seeds, are externally alike, have the mesocarp spongy-succulent, 6—10 mm. thick, and slightly thicker in its basal part than at the side. If the seed is abortive, it nevertheless completely fills the endocarpal cavity, has a very smooth surface and apparently seems perfect, but consists almost entirely of a fleshy hypertrophic mass of cellular tissue, derived from the integument, and containing in its central part the obsolete rudiments of the ovule, without any trace of the albumen. Fruits with a nearly normally conformed seed are some from Elmer's No. 11160 from the Philippines : in these the nucleus is covered with a thick dry (once fleshy) integument, penetrating into the orbicular cavity of the albumen, which is also evidently horse-shoe-shaped in vertical section, although somewhat imperfectly evolute for a teratological cause in my specimen ; otherwise it is indistinguishable from the seed of *M. Sagus.* Evidently the continuous multiplication of this species by offshoots has caused frequent imperfect sexual reproduction.

(The hypertrophic sterile seed of *M. Rumphii* is represented by Warburg in his study on the "Polynesischen Steinnuss Palmen" in Berich. Deut. Bot. Gesell. xiv, (1896), p. 138 t. X. f. 9).

Habitat.—Very widely cultivated on the swampy coasts of the different Islands of the Moluccas, especially in Ternate, Halmaheira, Amboina, and Ceram, and in N. E. Guinea, and the neighbouring islands, as Salwatty, Mysol, Aru and Key. I have seen specimens also from Celebes, from the Sangir group (North of Celebes), from Batjan (*Warburg*), from Java (*Zollinger* No. 1404 in Herb. de Cand. and Berlin), from Borneo (*Becc.* P. B. No. 3122), from Mindanao (Herb. Manila No. 5443, and *Elmer* No. 11160 in Herb. Becc.)

In Amboina, according to Rumph, it receives the name of "Lapia tuni"; in Mindanao of "Lumbia". In Salwatty it is named "Bi" and in N. E. New Guinea "Barian" or "Wariani" by the Mafor people (Beccari).

Zollinger writes that it is the "Ambulan" of the Javanese, and the "Kirai" of the Malays and Sundanese. According to Miquel is the "Kirai Karbau berduri" (the thorny buffalo Sagu) of the Malays of Java.

Observations.—It is distinguishable from *M. Sagus*, which it greatly resembles in having the leafsheaths, petioles and rhachises of the leaves more or less spinescent, and all the spathes, even those of the spike-bearing branches, also spinous. It differs also from *M. Sagus* by its fruits not being depressed, but slightly longer than broad. Very rarely are to be seen plants of *M. Rumphii* in flower or fruit, as they are always cut down before they attain the age of fertility, for otherwise the starch accumulated in the pithy tissue of their trunks would be lost, being utilized by the plant for the nourishment of its reproductive organs, and the ripening of the fruits. Even when the plant does produce fruits, they, although externally appearing to be normally evolute, almost always contain abortive or imperfectly evolute seeds.

The uses of *M. Rumphii* are the same as those of *M. Sagus*, and like that palm its principal product is the starch extracted from the stem, which is a very important article of commerce, and furnishes, more or less, the bread of the inhabitants of the countries where this Sagu Palm grows. In other ways this palm is also very useful in supplying very good material for the construction of houses, and for making numerous articles of domestic and common use.

For a full account of the manner of extraction and preparation of the starch and of the other commodities supplied by the Sagu tree, the reader may consult the chapter referring to its uses in the "Herbarium Amboinense" ll. cc.

Important information also is to be found in "De Nuttige planten van Nederlandsch-Indie, by K. Heyne (1913) i, 54.

Plate 105.—Metroxylon Rumphii *Mart.*—Branch of the spadix, bearing spikes covered with male and female hermaphrodite flowers; from a plant that flowered in the Botanic Garden of Calcutta (Herb. Beccari). Portion of a spike-bearing branch: on the spikes remain only a few female—hermaphrodite flowers, after all the male ones have disappeared; fruits in different positions; seed cut in halves showing the imperfectly evolute albumen; intermediate leaflet of a leaf from a full grown plant; from Elmer's No. 11160 in Herb. Beccari. In the lowest part

of the plate one abortive seed with hypertrophic integument, and the same seed cut vertically; from a Bornean specimen in alcohol (Herb. Beccari).

PLATE 106.—Metroxylon Rumphii *Mart.*—(The group of figures in the lower part of the plate, and at its right hand side.) The same fruits from Borneo, preserved in alcohol, represented in Plate 105; one of the fruits is cut vertically showing the endocarpal cavity, which contained the abortive seed also represented entire and in vertical section in Plate 105.

2a METROXYLON RUMPHII var. ROTANG Becc.

DESCRIPTION.—The leaves apparently are less spinous than those of the type; the rhachis towards the end of the leaf has only rudimentary spines on the back. The fruits are as in the type but somewhat smaller.

HABITAT.—West Ceram: Native name "Sagu Rotang." I mention this variety because it is recognised by the natives, but the specimens of it seen by me are too poor for judging of its value. The fruits are similar to those of the *forma typica* and well conformed externally, but have the seed reduced to only its hypertrophic integument. It is not to be confused with Rumph's *Sagu duri Rotang*, which corresponds to VAR. *micracanthum*, and has small fruits.

2b. METROXYLON RUMPHII var. LONGISPINUM Becc.

M. longispinum Mart. Hist. Nat. Palm. iii, 215, 343; Miq. Fl. Ind. Bat. iii, 146.

Sagus longispina Rumph, Herb. Amb. i, 75: Blume, Rumphia ii, 154.

Sagus longissima (sphalmate) Hamilt. in Mem. Wern. Soc. v, 320.

Sagus genuina var. *longissima* Giseke, Prael. in Ord. Nat. 94.

Sagus farinifera Poir. in Lam. Encycl. Bot. vi, 394.

DESCRIPTION.—It is doubtless a variety of *M. Rumphii*, having a more slender trunk, the leaves with longer spines on the petioles, and a larger fruit.

Rumph writes that no other Sagu tree, has spines so long, that its trunk is not so thick as that of "Sagu Tuni," the typical form of *M. Rumphii*, but that it is slender and similar to that of *Cocos nucifera;* that its "Gabba Gabba" (the petiole of the leaves used for the walls of the houses, etc.) do not last so long as those of *M. Rumphii*, and that its leaves are narrower, of thinner structure, more deeply green and more brittle, so as to render them less fit for "Ataps" (roofing) and that its trunk affords less starch than "Lapia Tuni" (*M. Rumphii* type). The fruits are described as of the size of a hen's egg, obliquely excavate in the lower part. He adds that it is the least esteemed of all known varieties or species of Sagu tree.

HABITAT.—Amboina at Huconalo or Rumatiga, Leytimor and Hitoe. Native name in Leytimor "Lapia Macanaru" and in Hitoe "Macanalo" and "Macanalum" (Rumph).

OBSERVATIONS.—I have not seen specimens which could with certainty be referred to this variety. Under the name of "Sagu Makanaro" I have received a variety

with small fruits, which I have considered as a subvariety of var. *micracanthum* (*M. Rumphii* var. *micracanthum* subvar. *Makanaro*) and which on account of its small fruits, evidently cannot be Rumph's *Sagus longispina*.

Under the name of *M. longispinum* were forwarded to me, also from Buitenzorg, some fruits a little smaller than those of the typical *M. Rumphii* (high and broad 35—37 mm.) flattish above and at the base, having the nucleus covered with a copious integument, and the chalazal cavity wide and shallow.

Plate 107.—Fig. 9.—Fruit and seed entire, and seed cut vertically, from the specimens received from Buitenzorg under the name of *Metroxylon longispinum*, mentioned above.

2c. Metroxylon Rumphii var. sylvestre Becc.

M. sylvestre Mart. Hist. Nat. Palm iii, 215, 343; Miq. Fl. Ind. Bat. iii, 146.

Sagus sylvestris Rumph. Herb. Amb. i, 75; Blume, Rumphia, ii. 153.

Sagus genuina var. *B sylvestris fructu perforato* Giseke, Prael. in Ord. Nat. 94.

Description.—Rumph describes his *Sagus sylvestris* as having a very high trunk covered with spines, shorter but more densely set than in any other; most probably, however, it is not precisely the trunk that is spinescent, but the spines are on the bases of the leaves that cover the trunk. The *fruits* are said to be smaller than in "Lapia Tuni" (the type of *M. Rumphii*), globular, depressed at the base and above, and having the seed perforated, or in other words, with the chalazal cavity so deep as to traverse the albumen from side to side. I have, however, often observed this in *M. Sagus*, where frequently the embryo penetrates the entire mass of the albumen, and with its apex attains the base of the chalazal fovea, in which case the albumen looks as if it were perforated.

Habitat.—According to Rumph this variety grows frequently in Ceram, but it is rare in Amboina. Native names "Lapia Ihur" and "Ihul."

Observations.—I have received from the Buitenzorg Herbarium a specimen named "Sagu Ihor" consisting of the terminal part of a leaf, and 3 fruits, gathered in the West of Ceram. The rhachis of the leaf is rather strongly spinescent beneath; the leaflets are long-acuminate, prolonged into a narrow tip and rather densely ciliate at the sides; the mid-costa is furnished with some long bristles on the upper surface towards the apex, and the margins are closely ciliate spinulous. The fruits are globular, inconspicuously beaked, very much like those of *M. Sagus*, 35—38 mm. across and 30—35 mm. high, and have the base excavate; the largest scales are 11—12 mm. broad in the exposed part, glossy, straw-coloured, with a darker faint intra-marginal line, and very narrow, discoloured, erosely-toothed margins. The pericarp has the uniform thickness of 2—3 mm. all round, and is not considerably more spongy at the base than elsewhere. One of the 3 fruits I dissected contained an abortive seed with hypertrophic integument as in *M. Sagus*. This specimen we may assume to represent really the *Sagus sylvestris* of Rumph, but in fact, as far as I can judge from the specimens at my disposal, it differs from *M. Rumphii* only in its smaller fruit, and in the leaflets being furnished with some long bristles.

Plate 107.—Fig. 1.—Metroxylon Rumphii var. sylvestre *Becc.* Two fruits received from Buitenzorg, coming from West Ceram and named "Sagu Ihor."

2d. Metroxylon Rumphii var. ceramense Becc.

Description.—I consider as representing this variety of *M. Rumphii* a form, evidently very common in Ceram, which differs from the type only in its smaller globular, non-depressed or oblong fruits, and in having leaves with very broad leaflets. Of this variety the natives recognize 4 secondary varieties distinguished by the following names: "Sagu Ceram"; "S. Merah" (or red); "S. putih" (or white); "S. hitam" (or black). All have spinous petioles.

2d′. *Subvar* platyphyllum Becc.

One leaflet is remarkably large, being 1·75 m. long and 12·5 cm. broad with its margins ciliate-spinulous, especially from the middle upwards. The only fruit I have seen is ovoid-oblong, rounded above, not attenuate below, and excavate at the base; it is 37 mm. long, and 26 mm. across; the scales are deeply grooved, the largest 8 mm. broad in the exposed part, with the apices slightly produced, and bluntish, the margins narrowly discoloured, and finely erosely-toothed. The fruit is almost the same as in the variety *ceramense rubrum*, but the specimens of the leaflet are considerably larger. If the wideness of the leaflets and the form of the fruit were constant characters, this would be a very distinct variety.

Habitat.—At Amahai on the south coast of Central Ceram. Native name "Sagu Ceram."

2d″. *Subvar.* rubrum Becc.—One leaflet is rather large but relatively narrow, 70 m. long, 7·5 cm. broad; the margins have few and short spines; the mid-costa is slightly spinulous near the apex. One fruit is ovoid-oblong, rounded above, not attenuate below, and excavate at the base, 3 cm. long, 22 mm. in diameter; scales deeply grooved, slightly produced in bluntish apices, the largest 8 mm. broad in the exposed part, the margins very narrowly discoloured, finely erosely-toothed.

Habitat.—Amahai in Ceram. Native name "Sagu merah."

2d‴. *Subvar.* album Becc.—One leaflet is 1·65 m. long, 10·5 cm. broad; the margins and the mid-costa slightly spinulous near the apex. Fruit globular, 32 mm. in diameter, rounded above, the base excavate; the largest scales 9—10 mm. wide in the exposed part, deeply grooved, slightly broader than long, the margins very narrowly discoloured, finely erosely-toothed.

Habitat.—Amahai in Ceram. Native name "Sagu putih."

Under this same native name I also received from West Ceram another specimen, which slightly differs from the one from Amahai in having smaller fruits, very slightly longer than broad, 25—27 mm. broad 26—30 mm. high; the pericarp is considerably more spongy at the base than above; the scales are less convex and with the apices more distinctly prolonged and acute.

2d⁗. *Subvar.* nigrum Becc.—One leaflet is 1·66 m. long and 9 cm. broad, has the margins rather densely ciliate-spinulous, and the mid-costa slightly spinulous near the apex. One fruit is globular, 3 cm. in diameter, rounded above and

excavate at the base, otherwise exactly the same as in variety *album*, a little smaller.

HABITAT.—Amahai in Ceram. Native name "Sagu hitam."

PLATE 107.—Figs. 2—6.—Metroxylon Rumphii VAR. ceramense *Becc.*—Fig. 2 *subvar.* album (from Amahai)—Fig. 3 *subvar.* album (from West Ceram)—Fig. 4 *subvar.* nigrum ;—Fig. 5 *subvar.* platyphyllum. Fig. 6 *subvar.* rubrum. (All specimens from Buitenzorg in Herb. Beccari.)

2e. METROXYLON RUMPHII var. MICRACANTHUM Becc.

M. micracanthum Mart. Hist. Nat. Palm. iii, 215 (2nd edit.) ; Miq. Fl. Ind.; Bat. iii, 146.

Sagus micracantha Bl. Rumphia, *ii*, 153.

Sagus duri rottang Rumph. Herb. Amb. *i*, 75 sub No. 1.

DESCRIPTION.—The name of *Sagus micracantha* was assigned by Blume to the *Sagus duri rottang* of the "Herbarium Amboinense" described by Rumph as having very small fruits and leaves armed with shorter spines than those of *M. Rumphii*, and similar to those of a *Calamus ;* I think, however, that a rigorous identification of this variety, with the description given by Rumph, to be a rather difficult task. Nevertheless it seems to me very probable that a variety named "Sagu Tuni," growing in West Ceram, of which I have received specimens from Buitenzorg, may correspond to *Sagus miracantha* Bl. Blume. Martius and Miquel have considered (doubtfully however) Rumph's *Sagus duri rottang* as corresponding to Labillardière's *Sagus genuina*, figured in Turpin's "Dictionnaire des Sciences Naturelles (Botanique), but although Labillardière's species is certainly a very near ally of *Sagus duri rottang* I prefer to consider it as a distinct variety.

Of the Metroxylon which I believe to correspond to the *Sagus duri rottang* I have seen only the end of a leaf, and a few fruits. The leaf has the dorsum of the rhachis spinescent to the extreme end, and the leaflets are distinctly ciliate-spinulous on the margins and on the mid-costa. The fruits are very small, some of them (having been evidently pressed one against the other) are oblong-obovoid, but one regularly evolute is globular, not depressed above, terminated by a slender pungent beak, is 23 mm. in diameter, has the base roundish, the scales very shiny, straw-coloured, and very narrowly discoloured on the margins. The pericarp is thin above, but gradually becomes thicker and more spongy at the sides, and is 6—7 mm. thick at the base.

HABITAT.—Rumph writes that the *Sagu duri rottang*, to which he adds the Amboinese name: "Lapia Luli-uwe," grows abundantly at Humohela (in Ceram), but that it is almost unknown in Amboina. The specimen I have considered as corresponding to it, comes from about the place mentioned by Rumph (West Ceram) and was labelled by the Buitenzorg collector "Sagu Tuni," a name, however, with which Rumph distinguishes the "Sagu" that has been generally considered as the typical *M. Rumphii*.

PLATE 107.—Fig. 12.—Metroxylon Rumphii VAR. micracanthum *Becc.*—Fruits from West Ceram, named "Sagu Tuni" by the Buitenzorg collector, and considered as corresponding to Rumph's *Sagu duri rottang* (Herb. Beccari).

2e[1]. Var. MICRACANTHUM *subvar.* MAKANARO *Becc.* It differs from the preceding in the fruits being a little larger, globular, 27—28 mm. in diameter. It forms a link with the variety *ceramense.* Rumph's "Lapia Macanaru" is quite another plant from the above, and is the *Metroxylon longispinum* of Martius (*M. Rumphii* VAR. *longispinum* Becc.) to which Rumph assigns a fruit as big as a hen's egg, and therefore not at all corresponding to our plant.

HABITAT.—West Ceram. Native name "Makanaro."

PLATE 107.—Fig. 11.—Metroxylon Rumphii, VAR. micracanthum, *subvar.* Makanaro. *Becc.*—Two fruits from West Ceram (Herb. Beccari).

2f. METROXYLON RUMPHII var. BURUENSE Becc.

Sagus genuina Labill. as to the figures of the fruit in Turpin's Dict. Sc. Nat (Bot.).

DESCRIPTION.—Probably not differing in habit from the typical *M. Rumphii Fruit* very small, globose, 18—20 mm. in diameter, flattish or slightly concave above, and minutely beaked, the base roundish or slightly unequal; scales in 18 vertical series, the largest 5 mm. broad in the exposed part, and with the apices slightly produced and obtuse, faintly grooved along the centre, glossy, straw-coloured with a narrow dark intra-marginal line and narrowly discoloured finely erose-ciliate margin; the pericarp relatively thick and spongy, especially at the base. The *seed* has the albumen homogeneous, horse-shoe shaped in vertical section, and the embryo basal, exactly as in the typical forms of *Metroxylon.*

OBSERVATIONS.—Buru (*Labillardière*).

HABITAT.—It is distinguishable by its very small, globose, not depressed fruits having the scales darker than in any other variety, and a relatively thick pericarp of uniform thickness all round. I have considered VAR. *buruense* as referable to *M. Rumphii*, but it could be as well related to *M. Sagus* as it is not known if it has spinous or smooth spathes, leaf-sheaths, and petioles.

The variety is established upon some fruits, collected by Labillardière in Buru, which are figured by Turpin (l. c.) in the plate representing *Sagus genuina* Labillardière.

Blume, Martius, and Miquel have supposed *Sagus genuina* Labill. to correspond to Rumph's "*Sagu duri rottang*;" but this latter I have reduced to *M. Rumphii* VAR. *ceramense*, and I now consider the fruits of the *Metroxylon* collected by Labillardière in Buru, as representing a distinct variety, perhaps more distinct from *M. Rumphii* (or *M. Sagus*) than any other.

Regarding these fruits, and the two plates representing *Sagus genuina* in Turpin's Dictionary I have to remark :—

(1) The specimens, on which the artist based his representation of *Sagus genuina* in Turpin's Dictionary, were mixed, as I have been able to verify by actual inspection of the specimens of *Metroxylon* collected by Labillardière in Buru, and preserved in the Herbaria of Florence, Paris and de Candolle; in fact these specimens consist of spike-bearing branches, and of detached fruits, parts evidently belonging to two distinct varieties. In the Paris Herbarium these specimens are

mixed up and loose in the sheet-covering, and with them are two labels, but it is not possible to ascertain to which specimens these labels respectively belong.

Of the spike-bearing branches some have spinous, and others smooth spathes. One of the detached fruits is large, and could belong to *M. Rumphii*, as well as to a variety of *M. Sagus;* several other fruits are very small, and correspond exactly to those figured in one of Turpin's plates and they represent the type upon which the VAR. *buruense* is established. We remain uncertain, however, if these fruits belong to the branches having spinous spathels or to those with the spathes smooth.

(2) In one of Turpin's plates, besides the fruit and its analysis (which unquestionably belongs to VAR. *buruense*) is represented not an entire spadix, but one of its spike-bearing branches, having spinescent spathes, but we do not know if it really belongs to the same variety as the fruits.

(3) From the analysis of the fruit in the above mentioned plate, it would appear that the seed had a ruminate albumen; but this certainly is not the case. The fruits collected by Labillardière, although they had attained their definitive size, were not thoroughly mature, and the seed they contained was dry and shrivelled, and may have had the appearance, on a superficial inspection, of having a ruminate albumen; but these fruits when restored by appropriate means to their former fresh condition, show the normal structure proper to all *Metroxylons*,—an albumen homogeneous, horse-shoe shaped in vertical section, having a large apical chalazal cavity, and a basal embryo. This false representation of the seed of *Sagus genuina* in Turpin's Dictionary has misled Martius, Blume, Miquel, Bentham and Hooker, and others, who have considered a ruminate albumen to be a generic character of *Metroxylon.* Drude in "Engler and Prantl's, Pflanzenfamilien" assigns a ruminate seed to *Eumetroxylon,* and an homogeneous one to his subgenus *Cœlococcus;* as a matter of fact, however, the seed is absolutely identical in both.

(4) Turpin's plate representing the general habit of *Sagus genuina* is also false, the spadices appearing as if they were emerging from the axils of the leaves and being much shorter than the leaves; but most certainly all true *Metroxylons* have a definite terminal inflorescence. Probably the artist, not having a flowering plant at hand, took as a model a sterile one, and added to it some detached spike-bearing branches, received from the natives.

Turpin's figure has been often reproduced in popular books of Botany contributing to give a false idea of the general habit of the Sago tree.

PLATE 107.—Fig. 10.—Metroxylon Rumphii VAR. buruense *Becc.*—Fruits collected by Labillardière in Buru (Paris Herbarium) and corresponding to the *Sagus genuina* of that author, figured in Turpin's Dictionary. See also the section of the seed in the analytical Plate VI. fig. 15.

2g. METROXYLON RUMPHII var. FLYRIVERENSE Becc.

Sagus Rumphii in L. M. D'Alberti's "New Guinea" Appendix.

DESCRIPTION.—*Fruit* turbinate, flat above and very minutely beaked, 4 cm. long, somewhat irregular by mutual pressure, 33 mm. broad at the uppermost part and thence slightly attenuate below; scales in 18 vertical series, convex, and deeply

grooved along the centre; the largest 9 mm. wide have the apices triangular, not produced, very appressed, and the margins very finely erosely-toothed, and very narrowly discoloured.

It is presumed to be a spinous plant, and accordingly is considered as a variety of *M. Rumphii*.

HABITAT.—Only one fruit was collected by L. M. D'Albertis on the Fly River in British New Guinea.

PLATE 107.—Fig. 13.—Metroxylon Rumphii VAR. flyriverense *Becc.*—The fruit representing the variety in Herb. Beccari.

3. METROXYLON SQUARROSUM Becc. n. sp.

DESCRIPTION.—Nothing is known of the general aspect of the plant, and the nature and degree of the spinescence of the leaves is uncertain. The *leaflets* are broadly ensiform, 1·10—1·40 m. long, 6—9 cm. broad, long-acuminate, the apex spinulous at the sides, and occasionally prolonged into a filament; the mid-costa is more or less spiny above, specially near the apex; underneath the mid-costa is covered entirely or partially with small paleolæ; the margins are either spinulous or nearly smooth: on the whole there are no reliable characters by which to distinguish the leaves of this species from those of *M. Rumphii* or *M. Sagus*. Of the *spadix* I have seen only a few detached fructiferous spikes; their spathes are apparently not spinous. *Male flowers.........Female flowers* in bud (remnants, undeveloped on the fruiting spikes) ovate, 5 mm. long and 3 mm. broad, rounded above, and not attenuate at the base; the calyx is split to the base (in the fruiting perianth) into 3 parts, smooth at the base, striately-veined in the upper two-thirds of their entire length; the corolla is about twice as long (or less) as the calyx; the petals are obtuse; ovary and stamens exactly as in *M. Rumphii*. *Spikes* 12—18 cm. long and about 15 mm. in diameter exclusive of the flowers; the pedicellar part is flattened, and has obtuse, glabrous margins (not sharp and tomentose as in *M. Rumphii* and *M. Sagus*); the spathels of the spike-bearing branches are apparently not spinous (always ?); the spathels have their upper half part triangular, dry, dark brown, scarious and brittle, protruding above the flower bracteoles, which are much less woolly than in *M. Rumphii* and *M. Sagus*, and giving on the whole a squarrose and glabrous appearance to the entire spike. The *fruits* are small, 20—25 mm. long, 18—23 mm. across, globular-turbinate or more or less distinctly narrowing to the base especially when numerous and crowded on the spikes, and in this case also they are more or less obsoletely angular; in no case are they excavate at the base; are flattish and rounded above, and terminated by a very distinct, slender mucro; scales in 18 vertical series, shiny, pale straw-coloured; the entire pericarp is thin in its upper part and at the sides, but is thicker at the base, owing to a greater development of the spongy mesocarp. *Seed* globular, enveloped by a thick integument; the albumen is horse-shoe-shaped in vertical section, has a deep apical chalazal cavity and a small basal embryo traversing the entire base of the albumen.

HABITAT.—At Waru in the East end of Ceram.

OBSERVATIONS.—Seemingly a distinct species, distinguishable by the glabrous and squarrose appearance of the spikes, owing to the spathels, which protrude their upper

third part beyond the slightly woolly floral bracteoles ; but especially is it characterised by the pedicellar part of the spikes, flattened but with convex faces and having obtuse margins, quite glabrous at the base, whereas, in all the allied species that part is flat, or else concave on the axial side, and has the margins acute and more or less densely villose ; it is characterised also by its very small fruits, more or less distinctly turbinate, or in any case not hollowed at the base.

It seems that frequently in this species numerous fruits arrive at perfect maturity on the spikes and become more or less angular, and distinctly attenuate at the base or turbinate by mutual pressure ; whereas, when they are loosely set, and may grow freely, they assume a more roundish shape. The seed is much smaller than that of *M. Sagus*, but otherwise it has the same structure.

Apparently the flowers of *M. squarrosum* also differ from those of *M. Rumphii* and *M. Sagus* in not being attenuate below and in having a rounded base.

The varieties of *Metroxylon* recognised by the natives at Waru, in the east end of Ceram, are seven in number, of which I have received specimens from Buitenzorg, all apparently being referable to *M. squarrosum*, but as far as I can judge from the scanty material at my disposal, barely distinguishable the one from the other from a systematic point of view. From the notes attached to each specimen, reproduced in the key, it would appear that some of the varieties have spinous trunks ; but probably it is only the leaf-sheaths covering the trunk that are spinous.

1. Var. KILWOI.—A *leaflet* is 1·05 m. long and 6 cm. wide, not very long acuminate, having spinulous margins in its upper two-thirds, and terminated by a linear caudiculum 7 cm. long, also spinulous at the sides ; the mid-costa is sparingly spinulous only near the apex. *Fruits* turbinate, 23 mm. long, 21—23 mm. broad, angular by mutual pressure, distinctly narrowing towards the base, flattish above and acutely beaked ; scales very convex, shiny, pale straw-coloured, not very deeply grooved along the centre, the largest 6—7 mm. wide in the exposed part, bordered by a very narrow reddish-brown band, and produced into a rather acute appressed point ; the margins are very finely erose-ciliate. The pericarp is thin, 1·5—2 mm. only, thick at the sides and above, and thicker and spongy at the base. (" No spines—Petioles green—" Note of the collector.)

2. Var. KILLASI.—A *leaflet* is 1·35 m. long and very broad (9 cm.) not very long-acuminate, with nearly smooth margins and furnished, near the apex only, with very small spinules ; the mid-costa also has only traces of spinules near the apex on the upper surface. One *spike* is 18 cm. long, and is supported by a pedicellar part 5 cm. long, 10—12 mm. wide, polished, flattened and with obtuse smooth margins ; a portion of its spathe still attached to it is not spinous. The *fruits* are exactly as in the var. *Kilwoi*, and of the same size, but some of them are not attenuate at the base, which is unequal and more or less rounded or flattish. This variety appears characterized by its very broad leaflets having slightly spinulous margins, and, according to the collector's note, by the want of spines, and by its gray petioles.

3. Var. KILKARUA.—A *leaflet* is relatively narrow, 1·08 m. long, and 6·5 cm. broad, very gradually and long acuminate, having the margins rather densely spinulous, and the mid-costa spinulous only in its apical part. A *spike* is 17 cm.

long. The *fruits* are exactly as in the var. *Kilwoi;* some, however, are globular depressed, flattish above, rounded and unequal at the base, 25 mm. in diameter, whereas others are distinctly turbinate, and from below the middle asymmetrical, and obsoletely angular by mutual pressure. In one fruit I have found two seeds, According to the collector's note the plant is covered from base to top with long and thick spines, and has petioles intensely green.

4. Var. KILATAN or KILATANKIRKIE.—A *leaflet* is rather narrow, 1·15 m. long, 6 cm. broad, gradually and long-acuminate, slightly spinulous on the margins; the mid-costa has only a few tuberculiform spinules near the apex. A *spike* is 13 cm. long. The *fruits* slightly differ from those of the other varieties in having a rounder top which is only slightly depressed around the beak; are more or less turbinate and at times have a roundish base, are 23—25 mm. long, and 19—23 mm. in diameter. Some of these fruits have a thoroughly mature seed, which is spherical, 15 mm. in diameter, covered with a crustaceous (once certainly fleshy) integument; the albumen in vertical section has a crescent-like or horse-shoe shape, and a large upper cavity; the walls of the albumen are 3—4 mm. thick; the embryo 4 mm. long, penetrating through the entire base of the albumen. ("Petioles long; spines short and thick"—collector's note.)

5. Var. KILKOUR.—A *leaflet* is narrow, 1·25 m. long, 6 cm. broad, rather long-acuminate; the apex is caudiculate; the margins are very distinctly ciliate-spinulous from the lower third upwards near the apex the cilia are 5—6 mm. long; the mid-costa is provided above, near the apex, with bristles 7—8 mm. long. The *spike* has a pedicellar part exactly as in the var. *Killasi* and is 18 cm. long. The *fruits* are exactly as in the var. *Kilwoi.* ("Considered th best variety. From base to top covered with moderately large spines. Trunk and branches white"—collector's note.)

6. Var. KILTAFUK.—A *leaflet* is narrow, 1·30 m. long, 5—7 cm. broad and very long-acuminate; the margins are unequally armed with rather rigid spinules from the middle upwards; the mid-costa has a few spinules, 3—4 mm. long near the apex. The *fruits* are not very different from those of the variety *Kilwoi,* but are a little smaller, 18—21 mm. long, slightly turbinate, non-depressed at the apex, which terminates in a conical pungent beak; the scales are more produced into an acute point than in the other varieties. ("From base to top covered with slender and moderately long spines. Petioles green. It grows only in swamps"—collector's note.)

7. Var. KILKIKIR.—A *leaflet* is shorter and relatively broader than in the preceding varieties, is 1 m. long, and 7 cm. broad, and is rather long-acuminate; the margins are almost absolutely smooth, but for the traces of a few spinules near the apex; the mid-costa has also only a few spinules near the apex. The *fruits* are exactly the same as in the var. *Kilwoi,* and the mature seed is as in the var. *Kilatan.* ("The trunk has no spines; the petioles are covered with dense tufts of short spines"—collector's note).

PLATE 108.—Metroxylon squarrosum *Becc.*—Fig. 1. Var. *Kilatankirkie:* one fruit is cut vertically through the seed—Fig. 2. Var. *Kilwoi.* Fig. 3. Var. *Killasi.* Fig. 4. Var. *Kilkarua*: one fruit in vertical section with two seeds visible. All

representing the type specimens in Herb. Beccari. See analytical plate VI in which figs. 12—13 represent the flower buds and fig. 14 the vertical section of the seed.

LATIN DIAGNOSIS.—Metroxylon squarrosum *Becc.* sp. nov. Spicarum facie glabrescenti ex spathellis bracteolarum tomentum conspicue superantibus; earum parte pedicellari complanato-biconvexa, marginibus obtusis glabris; fructibus parvis globoso-turbinatis.

4. METROXYLON WARBURGII Becc.

Cœlococcus Warburgi Heim in Bull. Agr. Col. Soc. Franc. de Colonis. 1902, p. 25 (extract) figs. 1—5 and in Bull. Soc. Bot. de Fr. i, (1904) 575, figs. 1—5.

DESCRIPTION.—Apparently a smaller plant than the other Sago Palms, but equally producing a terminal large-branched definite inflorescence. One *leaf*, apparently belonging to the upper part of a flowering plant, is on the whole 1·30 m. long; the leaf-sheath is coriaceous and provided along the centre of the dorsum with some short series of small pungent tubercles; the petiole is reduced almost to nothing; the rhachis is also armed, along the centre of the back, with small pungent tubercles; another still smaller leaf, has the sheath unarmed. The *leaflets* are frequently unequidistant or irregularly approximate in twos or threes on each side of the rhachis; they are very rigid-papyraceous or thinly coriaceous, ensiform, relatively narrow, very gradually narrowing above into a very long and very gradually acuminate flaccid tip; some detached leaflets, apparently from leaves of vigorous specimens, are 1·25 m. long and 3·5—5 cm. broad in their lower third and broadest part; they narrow a little below, and have reduplicate margins at the base; when dry are brown and dull above, and appear to have been conspicuously glaucous underneath; the mid-costa is prominent, sharp and smooth throughout above, superficial and without scales or paleolæ beneath; the secondary nerves are unequal, rather sharp but slender, rendering the blade plicate along them; they are not much stronger than several tertiary ones, and altogether contribute to render both surfaces, but especially the upper one, distinctly striate; transverse veinlets very minute, very close together and interrupted, rather distinct on the upper surface; margins acute and smooth or with only a few rudimentary spinules near the apex. Spikelet-bearing branches exactly as in the other *Metroxylons*, and bearing distichally and alternately 2—3 spikes on each side of the rhachis; their spathes are tubular-infundibuliform, not very obliquely truncate at the mouth and produced at one side into a triangular acuminate point; are coriaceous, glabrous, unarmed, and striately veined; they narrow somewhat at the base, where they are flattish and have acute and not villose margins in that part which is in contact with the pedicellar part of the underlying spike. The *spikes* are similar to those of *M. Rumphii* and *M. Sagus*, but have a glabrous appearance and, after the fall of the female flowers, show very regular series of deep pits in the places occupied by them; the spikes are 10—11 cm. long, and 15 mm. in diameter (exclusive of the flowers); spathels very broad and low, suddenly contracted into a triangular and acute point produced beyond the special floral bracteoles; the latter are more rigid and more developed than in any other *Metroxylon* known to me; the two external bracteoles are connate by their margins and embrace the two flowers existing at each spathel and are densely hairy on their

backs and on the upper margins; the special bracteole of the female flower is relatively large, hairy on the upper margin, and has two wings on the side of the male flower, by which that flower is in a great measure embraced; the other and more internal bract is cyathiform, also ciliate on the margin, and with the other and larger bract of the female flower forms a deep cup or calyculum. In the specimens seen the female flowers are just expanded and not one male flower is left on the spikes. The *female-hermaphrodite flowers* are elongate, cylindraceous, blunt, 11 mm. long, and 4 mm. wide; the calyx is coriaceous, cyathiform, attenuate at the base, dull and not striately veined, parted nearly to the middle into 3 broad semi-ovate obtuse lobes; the corolla is nearly twice as long as the calyx, and for two-thirds of its length divided into 3 oblong-cymbiform thickly cartilaginous segments, smooth and obsoletely punctulate outside, even when seen under a strong lens; the lower undivided third part is campanulate-ventricose and includes the ovary; the stamens have the broadened bases of the filaments connate with the ventricose part of the corolla, and form a rather elongate entire collar above the throat of the corolla, becoming afterwards free, subulate and introflexed at the apex; anthers versatile, elongate-elliptical, 5 mm. long, equally narrowing and acute at both ends; the cells shortly disjunct at the base; ovary ovoid, narrowing into an elongately conical style, which attains only the base of the free part of the filaments. The mature *fruit*, if developed freely, is obpyriform or obovoid, 10—12 cm. long, and 7—9 cm. across, narrows considerably to the base, is convex and slightly umbilicate on the top, and minutely beaked; frequently however the fruits are more or less deformed by mutual pressure, and assume an obpyramidate shape with obtuse angles, flat faces and an almost explanate top; the scales are in 24 vertical series, relatively small, glossy, of a light chestnut-brown colour having the edges narrowly discoloured, and the extreme margins obsoletely erose-toothed; they are deeply grooved along the centre, and consequently distinctly bigibbous, have the apices short, triangular, bluntish, and very appressed; the intermediate scales are 9—10 mm. long, and a little less broad. The pericarp is 5—6 mm. thick at the sides, and less above, but its lower half is filled with spongy tissue. The *seed* is in the broader upper part of the fruit, globular, about 5 cm. in diameter; its integument is 3—4 mm. thick; the chalazal cavity is large and suborbicular, and, as usual, the albumen is horse-shoe-shaped in vertical section; the embryo is basal.

HABITAT.—The New Hebrides. It was first made known to Prof. Heim by some fruits sent to the International Exhibition of Paris in 1900 as producing a kind of vegetable ivory, fit for button making. I afterwards recognized this species in some rather complete specimens forwarded by Mr. Perret to Prof. Martelli, in the year 1908, gathered in New Caledonia, on a plant introduced there from the New Hebrides. The specimens were accompanied with some not quite mature fruits, unmistakably however, referable to the species described by Prof. Heim. These fruits have all an obpyramidate trigonous form with very obtuse angles. To *M. Warburgii* I confidently refer also the specimens of a plant that flowered in the Botanic Garden at Singapore in the year 1891, which were distributed by Mr. Ridley under No. 3171. These specimens have only female hermaphrodite flowers on the spikes, from which the male flowers have all fallen.

OBSERVATIONS.—It is easily distinguishable from the other known species of *Metroxylon*, sectio *Cœlococcus*, by its leaves having narrow very long-acuminate rigid leaflets, glaucous beneath ; by the glabrous appearance of the spikes ; by the cylindraceous relatively large flowers, having the filaments of the stamens united in their basal part with the corolla, and forming a distinct elongate collar at its throat, before becoming free and subulate ; by the ovary reaching, with the summit of the style, only to the base of the free part of the filaments ; and especially by the obpyriform, frequently more or less angular or obpyramidate fruit, which has the seed in its upper part, while its lower half is filled with the spongy tissue of the mesocarp ; and finally by the seed being covered with a relatively copious integument, whereas this in other Ivory supplying species *Cœlococcus* is very scanty.

PLATE 109.—Metroxylon Warburgii *Becc.*—Spike-bearing branch bearing female-hermaphrodite flowers ; leaflet from an intermediate leaf of a full-grown plant : from the plant that flowered at Singapore, Ridley No. 3171. Fruits from Perret's specimens in Herb. Martelli. One of the fruits cut vertically to show the position of the seed. See analytical plate V—figs. 8—11 which represent the analyses of the female flower of *M. Warburgii* Becc.

5 9. METROXYLON UPOLUENSE Becc. sp. n.

DESCRIPTION.—*Fruit* obpyriform, 33 mm. long (in one specimen) and 25 mm. broad in its uppermost part, and thence gradually attenuate below to a narrow base, rounded and slightly umbilicate above, and surmounted by a small mucro. Scales in 24 longitudinal series, glossy, straw-coloured and with a shade of chestnut-brown near the margins, grooved broadly in their posticous part, and narrowly and faintly anticously ; the apices slightly produced and appressed ; the margins thin minutely erosely-toothed. Pericarp on the whole relatively thick (4 mm.) and with the lower third part of the fruit filled with a spongy mesocarp, the seed being in the upper two thirds. *Seed* erect, not seen mature by me, but apparently of the structure usual in *Metroxylon*. Other parts unknown.

HABITAT.—Cultivated at Upolu in Samoa (*Rechinger*).

OBSERVATIONS.—I have seen of this curious species only one fruit, which differs from those of the other known species by its regularly pyriform shape, and by its scales being arranged in 24 vertical series, a character by which it comes into the section *Cœlococcus*, despite its very small size. It shows, however, unmistakable affinity to *M. Warburgii*, from which it differs by its fruit being considerably smaller and less spongy at the base inside.

PLATE 107.—Fig. 14. Metroxylon upoluense *Becc.*—The fruit collected by Rechinger, and representing the type of the species.

LATIN DIAGNOSIS.—Metroxylon upoluense *Becc.* sp. nov. Fructibus parvis obpyriformibus in vertice umbilicatis et minute mucronatis, basi attenuatis, pericarpio in tertia inferiori parte pleno et spongioso ; squamarum orthostichis 24.

6. METROXYLON VITIENSE Benth. et Hook. Gen. Pl. iii, 934 ; Drake del Cast Illustr. Fl. Ins. Pacif. viii, 323.

Cœlococcus vitiensis H. Wendl. in Bonpl. 1862, 199 ; Warb. in Berich. Deut. Bot. Gesell. xiv, (1896) 141, pl. X, f. 12.

Sagus vitiensis H. Wendl. in Seem. Fl. Vit. 279, t. 80 and in Appendix to Seeman's "Viti", 444.

DESCRIPTION.—A large palm of the habit of a common Sago tree, specially when young, attaining 12—15 m. in height at the age of bearing, crowned by about 16 very large erecto-patent living leaves, besides a few (5—6) withered and hanging below them ; the oldest leaves fall to the ground and leave the *trunk* (which is 30—40 cm. in diameter) marked by approximate ring-like scars, and beset with spinescent adventitious ascendent rootlets, 12—25 mm. long. From the middle of the crown rises an immense inflorescence. After fructification the plant dies, as the trunk does not produce shoots from its base. The *leaves* are about 5 m. long; the petiole is armed in its lower part with complete rings of large confluent chestnut-brown spines, 4—7·5 cm. long ; higher up the spines are in semicircular rows. The *leaflets* are (apparently) equidistant on the rhachis, but not all on one plane ; one leaflet seen by me,—probably from the intermediate part of the leaf of an adult plant is lanceolate-ensiform, 1·30 m. long, and 9 cm. broad at its middle, very gradually acuminate to a long slender tip, rigid-papyraceous, but with the apex flaccid and recurved ; it is green and glossy on both surfaces, very slightly paler beneath, the mid-costa is very strong, very prominent, acute and quite smooth on the upper surface, superficially or slightly marked by a shallow furrow and devoid of scales or paleolæ underneath ; the blade looks more or less distinctly plicate along 4 secondary nerves on each side of the mid-costa, two of the plicæ being apparent on the upper and two on the lower surface ; tertiary nerves very numerous ; transverse veinlets sharp and very close together ; the margins sharp and smooth. In a leaf from a very young plant, the petiole is armed with slender spines, and the leaflets have the margins ciliate-spinulous, and the mid-costa sparsely spinulous in the upper surface from the middle up to the apex. The *inflorescence* is very large, forming a great diffuse panicle, 3·5 m. and more high, rising erect from the middle of the crown at the end of the life of the plant ; it is twice branched as it has a straight erect main axis, divided into 20 or more primary erecto-patent branches, 2·5 m. and more long, which are divided again into secondary, or spike-bearing branches ; these are similar to those of the common Sago palms, are slightly zig-zag sinuous, and carry distichally and alternately on each side a few spikes (4 in the specimen seen by me) ; their spathes are elongate infundibuliform and attenuate to a rather narrow base, are coriaceous and unarmed, have a very oblique mouth and are produced at one side into an acuminate blade, have strongly villose margins at the base, but are otherwise glabrous. The *spikes* have the pedicellar part villose at the margins on the axial side ; while still young and the flowers are still concealed by the spathels, the spikes have a squarrose appearance, and are chestnut-brown coloured, are 8—10 cm. long, apiculate, and 12—13 mm. in diameter ; the spathels terminate in a triangular acute point and are strongly striately veined. *Flower buds* obovoid-oblong, obtuse, tapering below

(5—6 mm. long in the specimens seen by me, but are perhaps larger when full grown); the calyx cyathiform, smooth, with 3 broad rounded lobes; the wool is not produced beyond the spathels even during the anthesis. *Fruit* globular or globular ovoid, having a rounded (not hollowed) base, and narrowing a little above, or very broadly conical in their upper part and minutely mucronulate at the apex; they are 5·5—6·5 cm. long, and 4·5—6 cm. broad; scales in about 28 longitudinal series, glossy, uniformly straw-coloured and narrowly discoloured on the edges, rather deeply and narrowly grooved along the centre, broader than long, the largest 10—11 mm. broad in the exposed part; are prolonged into a short bluntish point, their extreme margins are erose-toothed. Pericarp 4—5 mm. thick on the whole at the sides; the mesocarp corky. *Seed* globose, erect, the hilum exactly basal, orbicular; integument thin and adherent at the sides of the nucleus, but thick above; the nucleus alone slightly depressed, 4 cm. high, and 27—28 mm. across; it has a large and deep orbicular chalazal cavity, 12—15 mm. in diameter, slightly restrained at the mouth; the albumen is ivory-like, horse-shoe-shaped in vertical section, with walls 10—12 mm. thick. *Embryo* exactly basal, its position visible outside, being immersed in a pit-like depression, 5 mm. wide; the embryo cavity is ovate-conical, 6 mm. deep.

Habitat.—The Fiji Islands. It grows in swampy places in Viti Levu, Vanua Levu, and Ovalau; but is not found in Kadavu, the southern Island of the group (*Seemann*). It is said that a Sago Palm, supposed identical with *M. vitiense*, was observed by Dr. Bennett in Ratuma, one of the smaller islands of the group.

Native name in Fiji "Sagu" (pronounced "Songa"). The nuts furnish a kind of vegetable ivory, but are much less valued than those of *M. amicarum* and *M. salomonense* on account of their considerably smaller size.

Observations.—I have seen portions of Seemann's type specimens in the Herbarium at Berlin, and have based the description of the general habit of the palm on the original letter of Seemann to H. Wendland which is attached to those specimens. I have taken advantage also of some photographs taken in Fiji by Miss L. Gibbs. I purchased the fruits from a seed merchant. *M. vitiense* is the type upon which H. Wendland established the genus *Cœlococcus;* but in fact it does not differ from the common *Metroxylons* except in having a greater number of scales on the pericarp. The inflorescence of *M. vitiense* also slightly differs from that of *M. Rumphii* and *M. Sagus* in having a main elongate axis, from which the primary divisions start; whereas in *M. Rumphii* and allied species, the main axis of the inflorescence appears much abbreviated, and the primary branches spring from the axillas of the uppermost approximate leaves.

The species is particularly characterized by the form of the inflorescence, and by the globular-ovoid fruit with broadly conical apex and rounded base.

Plate 110.—Metroxylon vitiense *Benth.* et *Hook. f.*—One of the secondary or spike-bearing branches with very young flowers, just appearing outside the spathels; one leaflet of an adult plant from Seemann's specimens in the Herbarium at Berlin. Fruits (purchased); one cut vertically and with the seed entire in situ; others entire, and one having the seed cut vertically through the embryo; a vertical section of an isolated seed.

7. METROXYLON AMICARUM Becc.

Sagus amicarum Wendl. in Bot. Zeit, 1878, 115.

Cœlococcus amicarum Warb. in Berich. Deut. Bot. Gesell. xiv (1896), 140; W. F. Wight ex Safford, Useful Pl. of Guam in Contr. U. S. Nat. Herb. 9 (1905), 244, pls. 45—46; Merrill, Enum. Pl. of Guam in Philipp. Journ Sc. ix, (Botany), 1914, 63.

C. carolinensis Dingl. in Bot. Centralbl. xxxiii (1877), 347; Schum. and Lauterbach, Fl. Deut. Schutzg. in der Südsee, 1901 (Nach.), 606; Volkens in Engl. Bot. Jahrb xxxi, 419.

Metroxylon carolinense Becc. in Denkschriften der K. Akad. d. Wissensch. Math. Naturw. Klas. 4, Wien, lxxxix (1913), 60, f. 5 *a*, 5d.

DESCRIPTION.—A large palm of the usual habit of the common Sago trees, but with solitary non-proliferous *trunk*, 6—8 m. high, columnar and said to be spinescent (Kersting), crowned by 10—20 leaves, and covered with the bases of the old ones. The *leaves* are about 6 m. long, of which the lower third part is formed by the petiole (Volkens); it is not stated if the bases of the leaves and the petioles are smooth or spinescent. The *leaflets* are numerous, linear or lanceolate-ensiform, unicostate, straight, very acuminate, green and shiny on both surfaces, with smooth margins and mid-costa, except for a few spinules occasionally near the apex above on the mid-costa. The *inflorescence* is terminal, but apparently it is not so high as in *M. Rumphii*, *M. Sagus*, *M. vitiense*, etc., but is equally composed of several partial spadices, each of which issues from the axilla of one of the uppermost leaves. The *leaves* evidently persist on the plant to complete maturity of the fruits, which hang in clusters from among the leaves, the branches of the spadix not being able to stand erect, obviously from the great weight of the fruits; otherwise the inflorescence is terminal and has exactly the same structure as that of *M. Rumphii*, *M. Sagus*, etc., and as in those, its main divisions are composed of several spike-bearing branches. The *spikes* and the flowers are extremely like those of the common *Metroxylons*, and have like those the flowers in pairs, one being male and the other female-hermaphrodite; both are accompanied by the usual special bracteoles, although the latter are not very wooly and consequently the spikes have not a tomentose appearance. The *fruit* is very large, but very variable in size and has the usual structure of all *Metroxylons*, only its pericarp is clothed with more numerous *scales*, arranged in 24—28 vertical series instead of 18, as is the rule in all the species of the section *Eumetroxylon*. The *seed* is also exactly the same, has a large chalazal cavity in its upper part, an orbicular basilar hilum, an ivory-like albumen, horse-shoe-shaped in vertical section, and the embryo in proximity to the hilum.

HABITAT.—It was at first supposed that the native country of *M. amicarum* was Tahiti (the Friendly Islands), and in this belief it received such an inappropriate specific name, which, however, cannot now be changed. Its true native country is the Caroline group, and it is from those Islands, and especially from Panape that the seeds are exported to Germany. Volkens writes that he met with it in both the Truk Islands, belonging to the group. The plant receives the name of "Ivorynut-Palm," and the seeds are known as "Tahiti nuts' "Polynesian Ivory-nuts. "Sudsee-Steinnusse," etc.

OBSERVATIONS.—The seeds of *M. amicarum* have a very hard albumen, of an ivory-like structure and colour, and are one of the sources of the vegetable ivory used for button making, affording a good substitute to that afforded by the seeds of *Phytelephas*. On the structure and anatomy of the vegetable ivory produced by *Metroxylon amicarum* the following works may be consulted with advantage:—F. Hanausek: "The Microscopy of Technical Products (1907). The Polynesian Ivory-nut, p. 414, f. 249." By the same author "Zeitschr. allg. Osterr. Apoth. Ver., 1880, XIII, 360." Idem: "Zur Anatomie der Tahitinuss. Zeitschr, Unters. Hyg., 1893, VII, 197." Idem: "Realenzyklopadie d. ges. Pharm. 1 Aufl. IX., 590."

I have based the description of the general appearance of the inflorescence on a sketch of the fruiting plant kindly forwarded to me by Mr. P. Nelson of the "Guam Agricultural Experiment Station," but it was not stated if the plant perishes after fructification, as I think it must. In a note by Dr. Kersting attached to a specimen of the variety *majus* hereafter described, gathered by his collector Mr. Gibbon, when Dr. Kersting was General Commissioner of the Caroline, Marianne and Patan Islands, it is stated that the natives distinguish some varieties of the Ivory-nut Palm according to the length and breadth of the leaflets, but not by the form and size of the fruit. Dr. Kersting adds that he has not been able to distinguish such varieties. From the specimens I have been able to examine it has, however, appeared to me to be evident that some appreciable differences do exist among them, and accordingly I think that two principal varieties of *M. amicarum* may be distinguished, probably, however, connected by intermediate forms. In fact it is to be expected that some not perfectly identical forms of Ivory-nut Palm are growing in the different Islands composing the group of the Carolines, and that the varieties may have been once strictly localized; but now that this palm is planted for its nuts, certainly more than one variety may be encountered growing mixed in Panape.

If the differences in the breadth of the leaflets observable between Ledermann's No. 13409 and Gibbon's No. 1189 hereafter mentioned were constant, it would make one credit the opinion of the natives, that some varieties of Ivory-nut Palm can be distinguished by the size of the leaflets. At present I think that the two forms recognized by me may be characterized as follows:—

a var. COMMUNE.—*Leaflets* 6 cm. broad (the intermediate ones from a full grown plant?) *Spikes* (with fully developed flower buds) 22 mm. in diameter. *Flowers* 8—8·5 mm. long, 3·5—4 mm. across. *Fruit* slightly broader than high, 8—9 cm. in diameter. *Seed* 6·5 cm. in diameter.

b var. MAJUS.—*Leaflets* (as above) 10 cm. broad. *Spikes* (as above) 35 cm. in diameter. *Flowers* 12 mm. long, 5·6 mm. across. *Fruit* slightly longer than broad, 11—13 cm. high, 10·5—12 cm. in diameter. *Seed* 8—9 cm. in diameter.

As regards the given measurements of the leaflets, it has to be borne in mind that in herbarium specimens only a very small portion of the leaves and frequently only a few leaflets are available for study; that the leaves vary in size according to the age of the plant and on the same plant according to the place they occupy along the stem, and that in the same leaf the intermediate leaflets are usually larger than those of both ends. Generally the uppermost leaves, and especially those

immediately below the inflorescence, are smaller and have smaller leaflets than those of vigorous and middle-aged plants.

7a. Metroxylon amicarum var. commune Becc.

Description.—A large palm of the habit of *M. Rumphii* and allied species, 6—8 m. high, and producing a terminal definite inflorescence (Ledermann). *Leaves* very large ; in a small portion seen by me (Ledermann's No. 13409 in Berlin Herbarium), apparently cut from the upper third part of the leaf, the rhachis is marked by very minute impressed dots, is totally unarmed, and obsoletely angular along the dorsum ; the *leaflets* (in that portion of rhachis) are inserted at an angle of about 45°, apparently not disposed all on one plane, and not exactly equidistant, but slightly approximate in pairs on each side of the rhachis, linear-ensiform, very long-acuminate to a rather stiff apex, 1·05m. long, 6 cm. wide (or at times more ?), rigid-papyraceous, equally green and glossy on both surfaces or, perhaps, of a deeper green on the lower which is glabrous, and devoid of dots or micro-lepidia ; the mid-costa in the upper surface is very strong, prominent, acute and smooth, and is provided, but only near the apex, with a few distant spinules ; on the lower surface the mid-costa is superficial, or is represented by a shallow furrow and is devoid of paleolæ, unless these are very early deciduous ; the entire, blade looks plicate somewhat irregularly along the secondary nerves (3—4 on each side of the mid-costa) and has several other unequal and not regularly spaced secondary nerves, barely distinguishable from the numerous tertiary ones ; transverse veinlets numerous, and approximate ; margins very sharp and smooth. The *inflorescence* is terminal, 1·5 m. high, 4—5 m. wide (Ledermann), apparently composed of several partial spadices or inflorescences, issuing from the axils of the uppermost leaves. The portion of spadix seen by me reveals a general structure identical with that of the common kinds of Sago Palms ; the branches carry distichally and alternately a few amentiform spikes exactly as in *M. Rumphii* and *M. Sagus ;* the spathes sheathing the axis of the branches are also similar, tubular-infundibuliform, coriaceous, unarmed, very obliquely truncate at the mouth and produced at one side into an acuminate limb, dry and deflexed under the base of their respective spathes concave, and with the margins acute and woolly in the part that remains in contact with the pedicel of the underlying spike ; in young spadices the spathes of the branches are covered, especially above, with small appressed scales, later they are glabrous, and distinctly striately veined. The *spikes*, at the flowering time, are slightly curved upwards, 15—16 cm. long, and 15 mm. in diameter, exclusive of the flowers, and 22 mm. when covered with full grown flower buds ; the pedicellar part is completely concealed by the respective spathes and is attached nearly to the bottom of them ; its axial side is flat and the acute margins woolly-paleaceous ; the special spathe of the pedicellar part is bifid at the apex, and embraces the base of the spikes. The spathels (bracts of the spikes) are rigid-membranous, chestnut-brown, and, as in *M. Rumphii*, three of them are to be seen at the same time in a transverse section of the spike ; these are more or less connate by their margins, have only the apices free, triangular, and rather acute, are provided with paleaceous, later deciduous, hairs on the margins and are finely striately veined and glabrous, except for a few appressed scales near the apex. The *flowers* are very

crowded in gentle spirals, at times somewhat irregularly; inside the spathes every pair of flowers is enveloped by a bracteole formed by two united together, thinly membranous, brown and provided on both sides with a dense falcate tuft of paleaceous hairs; the *female hermaphrodite flower* has its bracteole membranous, two-keeled on the side of the male flower (which it embraces also) and hairy paleaceous on the keels; the second bracteole of the female flower is almost entirely reduced to a tuft of hairs. The full grown buds of the female—hermaphrodite flower, just before their opening, project with the entire length of the corolla above the spathels, are oblong, very obtuse, very obsoletely trigonous, 8—8·5 mm. long, 3·54 mm. across; the calyx is cyathiform, slightly tapering below, faintly striately veined, shortly 3-lobed, the lobes rounded; the corolla is a little less than twice as long as the calyx, is deeply parted into three oblong cymbiform, coriaceous segments, and has a short, entire, campanulate base. The stamens form with their united bases a campanulate cup, connate with the base of the corolla, and very shortly free above its throat; in the free part the filaments are elongate, thickish, with the apices truncate, but ending in a very minute introflexed apiculum, to which are attached the anthers a little above the middle of their dorsum. The anthers are elongate-elliptical, acute with parallel but somewhat irregular cells, 5—6 mm. long and deeply disjunct at the base. The female—hermaphrodite flowers have the ovary ovoid, narrowing above to an elongate, gradually acuminate, rigid, trigonous and 3-sulcate style, which with its acute stigmas attains to the apices of the anthers which at the time of the authesis are filled with pollen (active?) and are identical with those of the male flowers. The *male flowers* differ from the female ones only in the absence of the ovary, which is represented by three very small bodies, resting on the bottom of the staminal cup. *Fruit* globose, pomiform, usually slightly broader than high, 8—9 cm. in diameter, the base not hollowed, indeed slightly prominent, and obsoletely gibbous-costulate, broadly umbilicate and with a very small central conical mucro on the top; at times the entire periphery of the fruit is very obscurely 6-costulate longitudinally; *scales* shiny in 24—28 vertical series, the largest slightly broader than long (15 mm. long, 17 mm. broad), rather suddenly contracted into a slightly produced, appressed, acute or bluntish point, convex, faintly concentrically striate across, deeply grooved along the middle, the grooves continuous on all the scales of the same vertical series, reddish or yellowish brown blending to a darker marginal line; the margins narrowly discoloured and very minutely erosely-toothed. *Seed* globose, 6·5 cm. in diameter (in one specimen); its integument thin (not fleshy) and very adherent all round, except in correspondence with the chalaza, where it is thick and corky (when dry) and penetrates into the upper cavity of the albumen; the cavity is large, orbicular, 2·5 cm. in diameter and is slightly narrowed at the mouth; at the base the seed has a small depression corresponding to the place occupied by the embryo; the albumen is bony, white, homogenous, horse-shoe-shaped in vertical section, and has the walls 18—20 mm. thick. The largest of Ledermann's fruits weighs 175 grammes and the nut alone 110 grammes.

HABITAT.—The specimens I have described, consisting of portions of the leaves, flowers and fruits, were collected by Dr. C. Ledermann on the 8th October, 1913, in Panape, in the Eastern Carolines at Naupon mal (Patapat), between 2—300 m.

elevation, in damp and swampy places in a "bush" composed principally of *Hibiscus tiliaceus*, arborescent Ferns, *Pandanus*, etc. (*Ledermann* No. 13409 in Berlin Herbarium).

PLATE 111.—Metroxylon amicarum VAR. commune *Becc.*—Ledermann's specimen No. 13409 in the Herbarium at Berlin. Intermediate portion of a leaf, branch of the spadix bearing spikes having lost almost all their flowers; detached spike with some of the flowers on; fruit, seen from above, and seed, cut vertically through the embryo, also belonging to No. 13409.

In plate 113 are represented three other fruits, one of which is seen from the base, one from above and one laterally; one seed is cut vertically. All are from Ledermann's specimens.

In analytical plate V, figs. 1—7 represent the analyses of the flowers of *Metroxylon amicarum commune*. See the description of that plate.

7b. METROXYLON AMICARUM var. MAJUS Becc.

DESCRIPTION.—A detached leaflet is lanceolate-ensiform, 1·27 m. long, 10 cm. broad at its middle, is very gradually acuminate above to a regular subulate point, and has completely smooth margins and nerves. The spadices are larger than in variety *commune*, have the spathes more coriaceous and more elongate, and the spikes also considerably larger than in that variety, 14—16 cm. long, and when covered with full grown flower buds 3·5 cm. in diameter but exclusive of the flowers 2 cm. The *flowers* are also nearly one-third larger than those of the other variety, measuring 12 mm. in length and 5—6 mm. across; the anthers are 6 mm. long, so that, in proportion to the size of the flowers, are smaller than in variety *commune*. Two *fruits* (which, apparently, are those of the plant with large flowers and broad leaflets described above) are exceptionally large, 13 cm. high, 12 cm. in diameter and therefore slightly higher than broad, are obsoletely 6-costulate along the sides, narrow a little in their lower part and are slightly gibbous at the base; their upper part is rounded, but distinctly umbilicate at the apex which terminates in a small conical central beak; the pericarp is 5—6 mm. thick at the sides, slightly more above and at the base; the scales chestnut-brown are darker than in the fruits of the variety *commune*, and are disposed in 28 series; the largest scales are 2·5 cm. broad. One entire fruit weighs 390 grammes, and another 370. The nut is globose, 9 cm. in diameter, and weighs 260 grammes; it is slightly asymmetrical on the side of the chalaza, and opposite to it has a rather circular hollow, in which is placed the embryo.

HABITAT.—The description above is based upon specimens gathered by Dr. Kersting's collector, Mr. Gibbon (No. 1189 in the Berlin Herbarium), at Polonier in Panape and probably are from a cultivated plant.

Native name "Oj" ("Osch" in German orthography). The fruits were in the collection of Dr. Kersting, and Dr. Ledermann informs me that they were chosen from amongst some thousands, and represent the extreme size they may attain.

Observations.—Referable to the variety *majus* are also, apparently, some specimens gathered from plants cultivated in the Island of Guam, procured for me by the friendly assistance of Mr. Merrill of the Manila Botanical Establishment; these specimens are exactly identical with those of Panape, except that leaflets, flowers and fruit are a little smaller. The leaflets are 8·5 cm. broad. The spikes, covered with flower buds but not fully grown, are 15—16 cm. long and measure 20—21 mm. in diameter or considerably less than those of variety *majus*, but more than those with full grown buds of variety *commune*; but in great measure the size of the spikes depends on the age of the flowers. One fruit from the same source is also very similar to those of variety *majus*, but is somewhat smaller although considerably larger than those of the variety *commune*; it is also a little higher than broad obsoletely 6-costulate, narrows a little in its lower part, has basal gibbosities and is 11 cm. high and 10·5 cm. in diameter. The pericarp is thicker than in Gibbon's specimens, measuring 1 cm. at the sides and 15 mm. above and at the base. The seed is 82 mm. in diameter; the chalazal cavity is 32 mm. in diameter and slightly narrows at the mouth; the walls of the albumen are 20—22 mm. thick. The entire fruit weighs 280 grammes and the nut alone 185. From the plant growing in Guam Mr. Nelson sent to me a sketch representing the fruiting plant, with its leaves still standing erect, and the bunches of the heavy fruits hanging among them.

Plate 112.—Metroxylon amicarum var. majus *Becc.*—Branch of the spadix with spikes bearing fully developed flowers; two separate spikes with flower buds at different degrees of development; an entire leaflet. From Gibbon's No. 1189 in the Herbarium at Berlin.

Plate 113.—Metroxylon amicarum *Becc.*—The large fruit (entire) and the fruit in vertical section, with the seed *in situ*, and also entire, in the upper part of the plate, belong to the variety *majus* (Berlin Herbarium).

The fruit cut through the pericarp and the seed is from Guam, and is also considered as belonging to variety *majus*. The three entire fruits in different positions, and the seed in vertical section, in the lower part of the plate, are from Ledermann's collection and are referable to variety *commune*.

8. Metroxylon salomonense Becc. in Kechinger Bot. u. Zool. Ergebnisse, etc., in Denkschriften der K. Akad. d. Wissensch. Math. Naturw. Klasse, Wien, lxxxix (1913) 60, 61, f. 5*b*, 5*e*, 5*f*, 5*i* and p. 62 f. 7.

Cœlococcus salomonensis.—Warb. in Ber. Deutsch. Bot. Ges. (1896), 141; Schum and Lauterb. Fl. Deutsch. Schutzg., 1901 (Nachr.), 606.

Sagus sp. . . Guppy. The Solomon Islands, 83, 90, 303.

Description.—A large palm, 20m. and more high (Guppy), apparently non-soboliferous, producing a large terminal inflorescence. The *fruit* is globose, slightly depressed, 6 cm. high, 7 cm. in diameter, the apex slightly umbilicate and minutely beaked, the base obtuse and not excavate; the walls of the pericarp are 5—6 mm. thick at the sides; scales in 27 vertical series, 12 mm. broad in the exposed part, somewhat produced into a triangular acuminate apex, glossy, straw-coloured, having a narrow intramarginal dark line, and the margins and tips discoloured or greyish,

rather broadly grooved along the centre in the posticous part, and more narrowly anticously. *Seed* globular, somewhat depressed, 4·5—5 cm. high, 5·5—5·7 cm. broad, obsoletely sulcate longitudinally; the chalazal cavity deep and orbicular inside, but the mouth somewhat narrowed; the embryo is placed in a deep pit-like basal cavity; the albumen is crescent shaped in vertical section, its sides 2 cm. thick in their broadest part; the embryo is large, 6 mm. in diameter at the base and about 1 cm. long. Other parts unknown.

Habitat.—The Solomon Islands. Guppy writes of it that it grows in St. Christorval in dry situations, and that in Fauro and Treasury Islands groves of it occur both on the lower slopes and in the higher districts, on the summit of Treasury, at a height of about 300 m., and in Fauro at 450 m. It furnishes not only a commercial kind of vegetable ivory-nut, but supplies the natives with the Sago flour, which is an important item of their dietary, while the leaves are used for the roofs and walls of their houses. Regarding this palm Guppy writes also: "I often used to admire its heavy bole, terminating above in its handsome crown of massive branches. Although this palm when full grown has the appearance of great age and durability, it does not live more than 20 years, when it flowers, bears and dies. Native names 'Bia' and 'Nami'."

To *M. salomonense*, as described and figured by Warburg, exactly corresponds one fruit collected by Rechinger in the year 1905 near Friedrich Wilhelm's Hafen in German New Guinea (this is the fruit figured in Rechinger's work and by me in Plate 114). A fruit quite identical with the preceding is one bearing the No. 123 in the Berlin Herbarium, collected by Missionary Peekel at Namatanai, near Herbertshöhe, in Neu-Pommern (New Britain).

Observations.—This species is characterized by the apple-like fruit, not excavate at the base, and having its rather lengthy scales produced into a discoloured apex, and by the seed having the chalazal cavity which deeply penetrates the albumen, orbicular, and with a restricted opening.

Plate 114.—Metroxylon salomonense *Becc.* (The four figures in the upper part of the plate.)—Upper, lower and side views of the fruit collected by Rechinger in New Guinea; the same fruit in transverse section, having, however, the seed entire and *in situ*. See also the vertical section of the seed in the anatytical plate VI, f. 16, under the erroneous name of *M. samoense*.

9. Metroxylon bougainvillense Becc. in Denkschriften der K. Akad, Wissensch Math. Naturw. Klasse, Wien lxxxix (1913), 60, f. 5*c*, 61 f. 5*g*, 5*h*, 5*j* and 62.

Description.—Probably very similar in habit to *M. salomonense*, but with smaller fruits. One *leaflet*, apparently from a full grown plant, is elongate-lanceolate, 95 cm. in length, 10 cm. broad in its broadest part (about the middle), and thence gradually narrowing downwards to a rather acute base, and upwards to a very gradually acuminate apex; it is papyraceous, almost equally green on both surfaces, glossy above; the mid-costa is on the upper surface very strong, prominent and spinulous-serrulate from the middle upwards; underneath it is smooth and superficial;

secondary nerves 4—5 on each side of the mid-costa, not much stronger than the numerous tertiary ones; transverse veinlets very slender and approximate, more distinct above than underneath; margins acute, very minutely ciliate-spinulous. Some fragments of leaflets presumed to belong to this species, which apparently had been used for thatching or for the walls of a house, are extraordinarily large, being 19 cm. wide at their middle, and probably attaining the length of about 2 m. These leaflets of such a large size were probably from young and very vigorous plants. The only *fruit* seen by me is globular-depressed pomiform, conspicuously depressed-umbilicate above, somewhat excavate at the base 3·5—4 cm. high, 5·5 cm. broad; scales in 27 vertical series, the largest 9—10 mm. broad in the exposed part, somewhat produced into a triangular acuminate apex, glossy, straw-coloured, having a faint narrow darker intramarginal line and the margins and tips discoloured or grayish; also they are rather broadly grooved along the centre in the posticous part, and narrowly anticously. The pericarp is 10—12 mm. thick, and the *seed* is 2·5 cm. in diameter.

Habitat.—The leaflet and the fruit representing the type of this species were collected by *Dr. Rechinger*, in 1905, at Taberoi in Bougainville Island, and bear the No. 4878 in the Vienna Herbarium. The large fragmentary leaflets supposed to belong to the same species as No. 4878, bear the locality "Insel Bougainville, Bucht von Kieta."

Observations.—Very similar to *M. salomonense*, and perhaps only a variety of it, from which, however, it differs in its smaller, more depressed fruit with the base excavate, and the mesocarp considerably thicker, and in having a smaller seed.

The greyish colour of the margins of the scales in *M. bougainvillense* and *M. salomonense* is apparently due to a thin coating of a siliceous secretion, which flakes off in thin hyaline plates or lamellae.

Plate 114.—Metroxylon bougainvillense *Becc.* (The 4 figures in the lower part of the plate). Upper, lower and side view of a fruit collected by Rechinger in Bougainville Island; the same fruit in transverse section, with the seed (not thoroughly mature) entire and *in situ*. A vertical section of this seed is represented in fig. 17 in analytical plate VI.

EXCLUDED SPECIES.

Metroxylon oxybracteatum Warb. in Mons. ined. ex K. Schum. et Lauterb. Fl. Deut. Schutz. Geb. (1901) p. 202.

I have seen the authentic specimen, of this in the Berlin Hebarium where it is represented by only a spike, which apparently, is not that of a *Metroxylon*, nor of any other Palm.

Metroxylon textile Welw. Apont. (1858) 554—Raphia textilis *Welw.*

Metroxylon Ruffia Spreng. Syst. Veget. ii, 139.—Raphia Ruffia *Mart.*

Metroxylon viniferum Spreng. Syst. Veget. ii, 139 No. 2.—Raphia vinifera *Palis de Beauv.*

EXCLUDED SPECIES UNDER THE GENERIC NAME OF SAGUS.

Sagus farinifera Gaertn.—Raphia Ruffia *Mart.*

,, *laevis* Grifi. Palms Brit. Ind., only as to the plate CLXXXII.—Raphia Ruffia *Mart.*

,, *Palma-Pinus* Gaertn.—Raphia Gaertneri *Mann & Wendl.*

,, *pedunculata* Lam.—Raphia Ruffia *Mart.* (pedunculata.)

,, *Ruffia* Jacq.—Raphia Ruffia *Mart.*

,, *Ruffia* VAR *B* Willd.—Raphia vinifera *Pal. de Beauv.*

,, *taedigera* Mart.—Raphia taedigera *Mart.*

,, *vinifera* Lam.—Raphia Gaertneri *Mann & Wendl.*

SPURIOUS LEPIDOCARYEAE.

EUGEISSONA GRIFF.

Griff. in Calc. Journ. Nat. Hist. v, 101 cum ic., and Palms Brit. Ind. 109 and App. XXII. t. 220, 220 A. B. C.; Mart. Hist. Nat. Palm. iii, 212, 243, t. 179, 180; Miq. Fl. Ind. Bat. iii, 77; Becc. in Nuovo Giorn. Bot. It. iii, 18, and Malesia, iii, 58, and in Webbia iv. (1913) 190. f. 8. 10; Benth. et Hook. f. Gen. Plant. iii, 934 (*Eugeissonia*); Hook. f. Fl. Brit. Ind. vi, 480; Ridley, Mat. Fl. Mal. Penins. ii, 171.

Arboreous or short stemmed and caespitose monocarpic palms. *Leaves* elongate pinnate, having a broad elongate spinous base clasping the stem; the petiole very elongate, more or less spinous, channelled at the base, terete or obtusely trigonous above; the leaflets straight, unicostate, narrow, very acuminate, more or less bristly on the mid-costa above. *Infloresence* terminal, elongate, cupressiform or narrowly panicled, composed of several primary branches drawn together and more or less divided again, the ultimate divisions bearing solitary fascicled or secund flowers. Primary spathes coriaceous, tubular, closely sheathing; the lower ones often long-acuminate or caudate, spinous or smooth; spathes of the branches tubular-infundibuliform, truncate; a certain number of small spathes or spathels envelop the flowers, are coriaceous and imbricating, and form a kind of anthodium; the last spathel of the anthodium is usually two-keeled or two-winged on its back, its wings protecting a serotinous or abortive flower, or else only the rudiment of the prolongation of the axis. The *flowers* are large, of a very hard, coriaceous or almost woody, not perishable structure, hermaphrodite, but dichogamous and proterandrous, opening successively, and being of long physiological duration; at first they seem to be only male, having perfectly evolute stamens and a very small, almost rudimentary ovary; later, however, the same flower loses the anthers, and the ovary gradually developes, while only the filaments of the stamens remain in tufts at the base of the divisions of the corolla. (It may be that at times some flowers have not even a rudiment of an ovary, but apparently a flower having the ovary in course of development is never found without the remains of the stamens). The calyx is tubular-campanulate, more or less 3-lobed at the mouth, membranous-chartaceous or pergamentaceous. The corolla is very elongate and narrow, and has the apex acute and pungent; it is much longer than the calyx, is entire, tubular, of a thin and fleshy structure at its base only, in the part that remains inclosed in the calyx; in the remainder it is divided into 3 very elongate, thick, coriaceous or woody acuminate segments. Stamens numerous, from 24 to about 70, divided into 3 groups, one at the base of each of the 3 divisions of the corolla; filaments filiform, persistent; anthers deciduous, very elongate and narrow, attached by the base; the cells parallel; pollen violaceous. Ovary oblong, developing after the fall of the anthers, clothed with scales, incompletely 3-locular, the dissepiments not reaching to the centre; the loculi placed in the lowest and only fleshy part of the ovary, the upper part being coarsely fibrous and woody; ovules 3, erect from the base of the loculus; style very short, hard, 3-cleft at apex, the divisions connivent, stigmatose on the inner faces (Grifi.) or perhaps never spreading and stigmatose on the papillose angles of the trigonous style. *Fruit* large, ovoid, of a very hard structure, clothed with innumerable very small scales, and terminated by the persistent unchanged style. Pericarp on the whole rather thick, its mesocarp formed by coarse

fibres running longitudinally through a spongy or corky tissue ; endocarp very hard, woody or almost bony, having at its base a not exactly defined opening which is encirled by a crown of very coarse fibres. The endocarpal cavity is divided inside, very regularly, by 6—12 incomplete dissepiments, 3 of which reach nearly to the centre of the only seed it contains, and the others alternately remain shorter. *Seed* large, filling completely the endocarpal cavity, moulded to it and marked by as many furrows as there are dissepiments, the depth of the furrows corresponding to the length of the dissepiments. Albumen homogeneous, bony, often fissured in the centre. Embryo basal.

In a paper published in Martelli's "Webbia" iv, l.c. (Le Palme del Genere *Eugeissona* sono delle *Lepidocaryeae* o piultosto delle *Cocoineae*?) I have remarked that the systematic position at present assigned to *Eugeissonas* amongst the *Lepidocaryeae* is inappropriate, and that they are more closely related to the *Cocoineae* than to any other group of palms. In fact, with the exception of the scaly pericarp, the *Eugeissonas* have no other character in common with the *Lepidocaryeae*, as no other genus of this tribe has such inflorescence and flowers, and especially a fruit with the endocarp woody and pervious at its base. I think therefore that the *Eugeissonas* constitute an isolated group of palms, intermediate between the *Lepidocaryeae* and the *Cocoineae*, and that in any case they represent a subtribe of the latter.

Geographical distribution.—The species of *Eugeissona* known at present are only 6, and, with the exception of *E. tristis*, which is endemic in the Malay Peninsula, all are Bornean. In Borneo itself the species appear rather localized, *E. minor* however being an exception, as it was found in the extreme west of the island as well as in the north-west, but as *E. minor* is a species growing in swamps, it may have had its fruits dispersed by floods. The other species, however, grow in dry ground and especially on mountains (*E. insignis* in Sarawak), and having very hard and heavy fruits, it is not easy to understand how they have been dispersed, unless by the agency of terrestrial rodents. *E. utilis* is apparently relatively widespread in Borneo probably through the agency of man as it is a useful plant, from which a good sort of Sago flour is obtained, and accordingly receives a kind of rudimentary cultivation from some tribes of the interior of Borneo. (Beccari Nelle foreste di Borneo, p. 415, and Wanderings in the Great Forests of Borneo, p. 307.)

The species at present known, although much the same in habit and structure of flowers and fruits, nevertheless offer precise and easily appreciable diagnostic characters. Owing to the great localization of the species, probably several others remain to be discovered in Borneo.

EUGEISSONA.

Key to the species.

A.—Fruit divided internally by 6 incomplete dissepiments—

I. Almost stemless and caespitose.

Flowers 5 cm. long, style acutely trigonous, 2 mm. long.

1. E. tristis Griff.—Malay Peninsula.

Flowers 7—7·5 cm. long, style 5 mm. long having a conical base and narrowing above to a trigonous apex, stigmatiferous on the angles.

2. *E. ambigua* Becc.—Borneo : Region of the lakes of Kapuas.

II.—The stem very short, raised on long aerial roots.

Flowers 6 cm. long, style 3-gonous, 3·5 mm. long; stamens about 24. Fruit stoutly long-beaked.

3. *E. minor*.—Borneo, in Sarawak.

III.—Stem very high, tuberculate-spinous and having short roots at its base.

Flowers 7·5—8 cm. long, strongly falcate; stamens very numerous. Fruit terete, scales extremely small (⅓ mm. wide). Leaflets bristly on 3 nerves.

4. *E. utilis* Becc.—Borneo, Rejang River.

B.—Fruit divided internally by 12 incomplete dissepiments. Stem several metres high and with long aerial roots at its base.

Fruit 10—10·5 cm. long, ovoid, obsoletely 3-gonous, 6 cm. across the pericarp 6—7 mm. thick.

5. *E. insignis* Becc.—Borneo, Sarawak.

Fruit ovate, very shortly beaked-mammillate, 13 cm. long, 10 cm. across, circular in transverse section. The pericarp 16—17 mm. thick.

6. *E. major* Becc.—Dutch Borneo.

DESCRIPTION OF SPECIES.

1. EUGEISSONA TRISTIS Griff in Calc. Journ. Nat. Hist. v., 101, and Palms Brit. Ind. 110, t. CCXX A. B. C.; Mart. Hist. Nat. Palm. iii, 212, t. 179, 180 and Z XIV; Hook. f. Fl. Brit. Ind. vi, 481; Ridley, Mart. Fl. Mal. Penins ii, 171.

DESCRIPTION.—Stemless, growing in thick tufts, and without aerial roots. *Leaves* large, 2—3 m. long in the pinniferous part; the petiole about as long, roundish, armed with brown ascending flat spines; the rhachis smooth. *Leaflets* narrow, subulately acuminate, furnished with black setae only on the mid-costa above. *Inflorescence* cupressiform, shorter than the leaves, the panicle alone 1 m. long or thereabouts; its pedunculur part about as long, and spinescent (in Griffith's figure); the branches short, the lower two or three-flowered, the upper one-flowered. *Anthodia* elongate-elliptical, 13—14 mm. in diameter. *Flowers* at the time that the anthers shed their pollen 5 cm. long; the corolla entire, and of thin almost fleshy structure for about the lower third and divided above into three very hard linear or linear-lanceolate very acuminate segments, pungent at apex, 5 mm. broad, polished externally, striate internally, projecting 3 cm. outside the mouth of the anthodium; later (after the fall of the anthers) when the ovaries have increased in size, and still more when the fruits are fully grown, the corolla is completely divided into three spreading parts, broad and thin at the base, suddenly contracted,

narrow and woody above; the calyx is membrano-chartaceous, tubular-subcylindrical, slightly broadening above, striately-veined, and 3-toothed, the teeth short, acute or subaristate. Stamens inserted about midway of the corolla in tufts of 10—12 at the base of each of its divisions; filaments short; subulate; anthers long and narrow; pollen violaceous. Ovary at first, when the stamens are mature, situated at the bottom of the undivided part of the corolla, and only a few millimeters long; probably it is not ready for pollination until the anthers have disappeared, and it has reached the throat of the corolla or about the level of the mouth of the anthodium; at that time the ovary is oblong, very obsoletely trigonous, slightly attenuate above, rounded on the top; the style is very short, 2 mm. long, very acutely 3-gonous, papillose-stigmatiferous above on the angles. *Fruit* 6·5—8 cm. long, 3·5—4 cm. through, ovate or ovate-oblong, terete, more or less suddenly stoutly and elongately rostrate or narrowing above to a conical or very obtusely-trigonous pyramidate point, obtuse at the extreme apex, and terminated by the persistent style; *scales* squarrose, flat, chestnut-brown, lighter at the edges, glossy, the largest 1·5—2 mm. broad, somewhat prolonged into erose-toothed and (when not much rubbed) ciliate fringed apices; the endocarpal cavity is divided into six incomplete dissepiments, three of which penetrate very deeply while three are shorter and alternate with the others. *Seed* large, 2·5 cm. long, 2 cm. across, marked by six deep narrow longitudinal furrows, into which the dissepiments of the endocarp fit, three very deeply, and the others less so; embryo basal; wall of the pericarp 4 mm. thick at its middle; the endocarp alone is 2 mm. thick.

HABITAT.—In the forests on the hills about Ching (Malacca) it is very common. It is also common in Penang (*Griff.*). I have had specimens from Kolang, in Selangor (*Fr. Keheding*, Herb. Becc.). Ridely gives also the following localities: Johor, *Gunong* Pulai (*Ridley*). Malacca: Sungei Hudang (*Goodenough*, 1401). Selangor: Kwala Lumpur. Perak; Larut Hills to 25·00 feet alt.; Dindings; Penang (*Curtis* 2218).

Native name "Bertam." According to Ridley the leaves are used as those of other palms; the stalk of the inflorescence is sometimes carved into ornamental walking sticks; the fruit is eatable (probably the not quite hardened albumen—Becc.).

OBSERVATIONS.—It is distinguishable by its caespitose habit and by the short stems not producing aerial roots; by the leaflets being bristly only on the mid-costa; by the elongate cupressiform inflorescence having the peduncular part spinous; by the flowers 5 cm. long; by the corolla entire in its lower third part; by the style being only 2 mm. long and acutely 3-gonous; by the ovate-oblong fruit conically long-rostrate and having six incomplete dissepiment; by the relatively large (1·5—2 mm. broad) scales; and by the entire pericarp 4 mm. thick and the endocarp alone 2 mm. thick.

PLATE 115(A).—Eugeissona tristis *Griff.*—Fruits entire; vertical section of a fruit through the seed; vertical section of a fruit showing the internal dissepiments without the seed; transverse median section of a fruit; flower at the time that

the ovary has reached the mouth of the corolla; detached ovary; seed. From Keheding's specimens collected in Selangor.

2. Eugeissona ambigua Becc.

E. tristis (non Griff.) Becc. in Nuovo Giorn. Bot. Ital. iii, 28.

Description.—Stemless, caespitose and without aerial roots. Petiole obtusely trigonous, armed in its lower part with flat, laminar, long and short, black spines, and covered, as well as the lower face of the rhachis, with very dark, very thin and appressed scales. *Leaflets* narrow, setose only on the mid-costa above. *Spadix* cupressiform, similar to that of *E. tristis*. *Flowers* narrow, falcate, 7—7·5 cm. long. The corolla is tubular and entire in its lowest third; its divisions are 6 mm. wide, very thick, and have the apex subtrigonous; the calyx is campanulate, 17 mm. long, broadly 3-lobed, the lobes obtuse; stamens apparently in groups of 10—12 at the base of each division of the corolla; growing ovaries when 3—4 cm. in length, obtusely 3-gonous, truncate at apex, where the angles are terminated by an inconspicuous but almost pungent point; style 5 mm. long, with a conical base, and narrowing into a slender 3-gonous apex, papillose stigmatiferous on the angles; *scales* almost uniformly dark chestnut-brown, flat and apparently a little smaller than in *E. tristis*, the largest being not quite 1 mm. broad. The *fruits* are unknown, but probably have no more than six dissepiments, as far as can be inferred from the growing ovaries.

Habitat.—Central Borneo, at Segrat on the river Unpanang, near the lakes of the Kapuas, on slightly raised hillocks isolated in the plain, named "Mattangs" by the Malays, and having a peculiar vegetation, quite different from that around them, and especially characterized by an umbelliform *Casuarina* (*Beccari*, P. B. No. 3443).

Observations.—It is related to *E. tristis*, from which it differs, as from any other at present known species, in the relatively elongate style, of the peculiar form described above. Apparently it differs from *E. tristis* also in having the angles of the apex of the growing ovaries terminated by three inconspicuous but pungent points, whereas the ovaries of the same age in *E. tristis* have the apex rounded, exclusive of the short trigonous style. It is also distinguishable from the other Bornean species by its short stems, not propped by long aerial roots; by the leaflets having the mid-costa alone bristly; by the flowers 7—7·5 cm. long, having the corolla entire, but finally splitting in its lowest third part; and by the scales (of the very young fruits) being only about 1 mm. broad or smaller than in *E. tristis* and *E. minor*, but larger than those of *E. utilis*.

Plate 115(B).—Eugeissona ambigua *Becc.* Branchlet with anthodia; flower with growing ovary; the ovary. From Beccari's P. B. No. 3443.

3. Eugeissona minor Becc. in Nuovo Giorn. Bot. Ital. iii, 18.

Description.—The entire plant is 3—5 m. high; the stem itself, however, is very short, but raised above the ground and propped by aerial roots about 1 m. long. *Leaves* 4—5 m. long on the whole, the pinniferous part alone being about 2 m. long; the petiole about as long, terete, 1 cm. in diameter, thickly sprinkled with small, appressed, tobacco-coloured scales and armed, near the base, with

short, rigid, black, ascendent spines, otherwise smooth; the rhachis is trigonous with an acute salient angle above. *Leaflets* numerous, equidistant, the lower and those of the middle 50 cm. long, 2—3 cm. broad, the others gradually smaller; the mid-costa smooth or furnished on the upper surface only with a few very short spinules near the apex. *Spadix* short, paniculate, and on the whole 40—50 cm. long; the pedicellar part short and smooth; the panicle alone 25—30 cm. long and composed of only 3—6 very short appressed branches, each bearing 3-7 sessile, very approximate flowers. Spathes unarmed. The *anthodia* are formed of 16—18 spathels, are oblong, slightly ventricose and (in fully developed flowers) 3—3·5 cm. long, 12 mm. across. The fully developed *flowers* are 6 cm. long not including the anthodium; the calyx is tubular, subcylindrical, slightly broadening out above, 20—22 mm. long, 3-toothed, the teeth short, triangular, acute or bluntish; the corolla is at first entire in its lowest third, but after the fall of the anthers and when the ovary begins to increase in size, becomes deeply cleft and finally (at the fruiting stage) completely divided into three parts, very broad at their bases, and spreading under the fruit; that part of the divisions of the corolla that remains outside of the anthodium is 4 cm. in length; the divisions are very hard, linear, straight or obliquely acuminate-pungent, deeply bisulcate-striate internally, glossy, vernicose externally; the stamens are relatively few, inserted in tufts of about eight a little above the base of each division of the corolla; filaments short, subulate; anthers narrow, about 2 cm. long. Ovary at the time it attains to the bases of the stamens (probably at the moment of pollination) is oblong and obtusely trigonous; the style is 3·5 mm. long, acutely trigonous, at times more or less distinctly twisted, bluntish, dark chestnut-brown and glossy, papillose stigmatiferous on the margins. *Fruit* 7 cm. long and 4 cm. across, broadly ovoid and very obtusely trigonous, very suddenly and stoutly rostrate, being contracted at about its uppermost third part into a trigonous pyramidate apex terminated by the persistent and unchanged style. *Scales* squarrose, slightly excavate at the base, chestnut-brown and glossy, the edges; and especially the apices of much lighter colour and erosely-fringed on the margin; the largest scales are 1·5 mm. wide. The walls of the pericarp at about its middle are 4 mm. thick; the endocarpal cavity is divided, as in *E. tristis*, into three long and three short incomplete alternating dissepiments. *Seed* (not seen mature) but most probably very similar to that of *E. tristis*.

Habitat.—Borneo. I collected this curious palm, so very peculiar by its aerial roots, in marshy places in the plain between Sodomae and Gunong Poe in Sarawak (P. B. No. 2444 in Herb. Beccari). I consider also to belong to this species some fruits received from Kew, collected on the Barram river in North-west Borneo by *J. Hewitt* in September 1907. The roots supply very good walking canes and umbrella sticks.

Observations.—It much resembles *E. tristis*, but is at once distinguishable from it, as from all the other species at present known, by its short stem raised above the ground by long aerial roots and by its short spadices, having the panicle composed of few flowers (only 20—30 on the whole) supported on a short, smooth, peduncular part. It is also characterized by its flowers 6 cm. long;

by its corolla being entire in its lowermost third part; by the stamens being relatively not very numerous (about 24 in 3 groups); by its fruit elongate and stoutly beaked and with six dissepiments; by the style 3·5 mm. long and trigonous; by the scales slighly excavate at the base and 1·5 mm. wide; finally by its leaflets having the mid-costa only slightly spinulous on the upper surface near the apex, instead of having the long setae of the other species in that part.

PLATE 116.—Eugeissona minor *Becc.*—Upper end of a leaf; an entire spadix with unopened flowers; upper part of a spadix at the time that ovaries are ready (apparently) for pollination; two fruits entire, and transverse section of another not thoroughly mature. From the type specimens Beccari's P. B. No. 2444.

4. EUGEISSONA UTILIS Becc. in Nuovo Giorn. Bot. Ital iii, 26.

DESCRIPTION.—A fine palm, 12—15 m. high on the whole. The *stem* is straight, cylindrical, furnished at the base with a mass of numerous short roots (not propped by aerial roots), and more or less stripped of leaves to a considerable height at times as high as 9 m. up, the oldest leaves being naturally deciduous; the surface of the stem is marked by the scars left by the fallen leaves, and roughened by numerous short, subspiny, abortive, adventitious roots. *Leaves* large, the inner spreading, the lower arched and recurved; petiole elongate, glabrous, armed on its lower part with scattered flat, laminar, black, rather short, 10—12 mm. long spines; higher up it is smooth or nearly so, where it is flat on the upper surface, but with an obtuse angle on the lower, so that in transverse section it is trigonous; the rhachis is also glabrous and unarmed, and has an acute salient angle above. *Leaflets* very numerous, equidistant, narrow, subulately acuminate, furnished on the upper surface with long bristles on the mid-costa and also on a slender nerve near each margin; the lower leaflets and central leaflets are 40—45 cm. long, 20—22 mm. broad, the upper ones gradually smaller. *Spadix* very large, cupressiform, rising erect from the centre of the crown and composed of numerous main branches, appressed to the main axis in their basal part, but arched and spreading above; they bear unilaterally at every spathe a secondary branch with many flowers at their basal part, but with fewer flowers above; spathes of the branches smooth. The *anthodia* are shortly pedicellate, and formed of 12—13 spathels, are oblong, slightly ventricose, about 4 cm. long, 12—13 mm. across. The fully developed *flowers* are 8—9 cm. long including the anthodium; the flowers alone measure 7·5—8 cm.; the calyx is tubular campanulate, 25 mm. long, 3 toothed, the teeth deltoid, acute; the corolla at first is entire to nearly the fourth of its lower part, later it splits completely open; the divisions of the corolla are narrow, falciform and pungent, purplish-black and vernicose outside, concave and striate inside; the part which protrudes beyond the anthodium is 4—5 cm. in length. Stamens numerous (about 70), unequal in length; the anthers very narrowly linear, about 3 cm. long; the pollen violaceous. Ovary (at the time of the maturity of the anthers) small, turbinate, about 1 cm. long, the style 2 mm. long, very acutely trigonous, papillose-stigmatiferous on the angles. *Fruit* 8—10 cm. long, 5—5·5 cm. across, obovate, tapering a little below, circular in transverse section, very suddenly contracted above into a very stout, obtusely-trigonous-pyramidate rostrum (15 mm. long) blunt, and terminated by the persistent very small style; *Scales* extremely minute and numerous, about one-third of a mm. wide, produced into long

acuminate, slightly discoloured apices. The endocarpal cavity is divided into six incomplete dissepiments, three penetrating very deeply nearly to the centre of the fruit, and three being somewhat shorter; the three principal dissepiments are deeply sulcate along their internal margin or in transverse section bi-lobed at the free end. *Seed* moulded to the endo-carpal cavity, and therefore marked with six furrows, of which three are deeper than the others; wall of the pericarp 5—6 mm. thick on the whole; the endocarp alone 1·5 mm. thick.

HABITAT.—I have found this palm common in Borneo on the banks of the Upper Rejang, in the Kayan and Punan country, especially near houses where this palm receives a rudimentary culture for the sake of the Sago flour obtainable from its trunk. Probably for this same reason it is a plant more diffused throughout central Borneo than other species of the same genus. To this same species probably also belong the *Eugeissona* trees I have seen growing in abundance on the hills bordering the Bruni river in North Borneo, and on the elevated part of Pulo (Island) Burung, near the mouth of the Batang Lupar. Native name "Kadjattao" (*Beccari* P. B. No. 3812.)

The tree reproduces itself with great facility by seed, and it is of very rapid growth, in five years in good soil coming to bloom, which is the proper time for the extraction of the fecula. The pollen, which is produced in prodigious quantity, is also used as food by the natives.

OBSERVATIONS.—It is distinguishable by its naked trunk, furnished at the base with short roots, and rough all over from tuberculiform, subspiny, adventitious rootlets; by the equidistant leaflets bristly on three nerves above; by the very large cupressiform spadix; by the flowers (7·5—8 cm. long) having the corolla entire in its lowermost third part; by the very numerous stamens (about 70); by the acutely trigonous, 2 mm. long style; by the fruit, ovoid, circular in transverse section, 8—10 cm. long, 5—5·5 cm. through, shortly and stoutly beaked with six incomplete dissepiments; by the very small scales, ½mm. wide; by the pericarp 5—6 mm. thick on the whole, the endocarp alone being 1·5 mm. thick.

PLATE 117.—Eugeissona utilis *Becc.*—Intermediate portion of a leaf; flower-bearing branch; two entire fruits; the nucleus alone of one fruit spontaneously divested of its mesocarp; transverse section of the nucleus (the seed rotten). From Beccari's P. B. No. 3812.

5. EUGEISSONA INSIGNIS Becc. in Nuovo Giorn. Bot. Ital. iii, 22.

DESCRIPTION.—Palm of the general habit of a Sago tree, 12—15 m. high on the whole, the *stem* alone 7—8 m. high, emitting from its base numerous strong aerial roots, 1—3 m. long. The *stem* is cylindrical but is entirely covered by the persistent bases of the leaves, which fall down only in the last stage of the life of the plant when the fruits are ripening. The leaves are distinctly 3-seriate, following gentle spirals along the trunk; they are (including the petioles) 6—8 m. long, erect, and appressed a long way along the trunk but spreading their feathery upper part; the leafsheaths are spinous, elongate and costulate on the middle of the dorsum, and owing to their 3-seriate arrangement give an acutely trigonous appearance to the entire trunk; the petiole is elongate and powerfully armed, especially near the base, with laminar, very rigid, black spines 2—4 cm. long, the

spines being gradually feebler above, finally disappearing near the upper end ; in leaves of young plants the petiole and the rhachis are densely sprinkled with very dark, very appressed scales. The rhachis is smooth and has a very sharp salient angle above. The *leaflets*, in leaves of young plants, are subequidistant ; but in full grown plants are in pairs or in threes on each side of the rhachis ; the largest of them (which are the intermediate ones) are as much as 1 m. in length, and 25—30 mm. in breadth ; all have the mid-costa sharp and much raised, and furnished with long distant bristles ; the upper leaflets are gradually smaller. *Spadix* very large, cupressiform, rising erect from the centre of the crown, about 4 mm. high, composed of numerous short branches, appressed to the main axis, but with their apices spreading or outcurved ; these primary branches bear unilaterally at every spathe a secondary branch, occasionally divided again ; the lower divisions carry many flowers, the upper have gradually fewer. Primary spathes spinous ; the spathes of the branches smooth, but at times with a straggling spine or two on their backs. The *anthodia* are more or less pedicellate and covered with numerous spathels (as many as 20—22 if the pedicellar part is very elongate), are oblong, slightly ventricose, about 4 cm. long not taking into account the pedicellar part, and 15 mm. across. The fully developed *flowers* including the anthodium are 10 cm. long ; the full grown flower-buds are distinctly falcate, obsoletely-trigonous, very gradually acuminate-pungent ; the calyx is tubular-campanulate, 25 mm. long, usually 3-toothed, the teeth obtuse or acute, but at times the calyx is almost entire and truncate ; the corolla has a short basal entire part, 18—20 mm. in length ; its divisions are convex and polished externally, concave and striate internally, very narrow (6 mm. wide) ; the part outside the anthodium is 6 cm. in length ; stamens numerous, 50 or more ; the filaments about 1 cm. long ; anthers very narrowly linear, unequal, about 4 cm. long ; ovary (at the time of the maturity of the anthers) small, oblong, 7—8 mm. long : the stigmatiferous style is trigonous, 2·5 mm. long. *Fruit* 10—10·5 cm. long, 6 cm. across, obovoid, very obsoletely trigonous, very suddenly contracted into a stout obtusely trigonous-pyramidate blunt rostrum, 15—18 mm. long, and terminated by the persistent very small style. *Scales* almost of a uniform dark chestnut-brown colour, very small ; the largest 1·5 mm. broad, lanceolate, very acuminate, disposed in very many vertical series, so as to give to the entire fruit the appearance of being very closely striate longitudinally. The pericarp on the whole is 7 mm. thick in its intermediate part ; the endocarp alone is 3 mm. thick ; the cavity is divided very regularly into 12 incomplete dissepiments, of which the three principal penetrate very deeply (nearly to the centre of the fruit) and are distinctly bilobed in transverse section at their internal free end, 3 are somewhat shorter, and 6 shorter still. *Seed* 4·5—4·8 cm. in diameter, 6 cm. long, ivory-bony, fissured in the centre, conspicuously marked by as many deep furrows as there are dissepiments in the endocarpal cavity to which the seed is moulded.

HABITAT.—Borneo : on Mount Mattang, near Kuching in Sarawak, at 7—800 m. elevation (*Beccari* P. B. No. 2010). I have observed the same plant growing also on the tops of other hills near the sources of the Sarawak river, and on Mt. Linga, near the mouth of the Batang Lupar. Native name "Djatto" "Kadjatto" or "Kadjattao."

The large, long, straight aerial roots when not completely lignified, can be readily split longitudinally, and the fibro-vascular bundles separated. The Dyaks in Sarawak profit by this peculiarity to obtain from the aerial roots fine and neatly finished very tough filaments, about 1 mm. thick and 2—3 m. long, with which, when dyed in various colours, small bags (tambuks), necklaces, bracelets etc., are made. From the largest and hardened roots very fine walking sticks are also made.

Observations.—It is characterized by its trunk rather high, propped by long aerial roots, and rendered trigonous by the 3-seriate permanent bases of the leaves; by the leaflets being bristly on the mid-costa; by its falcate flowers 10 cm. long; by the corolla having a very short (only 18—20 mm. in length) tubular basal part; by its numerous (50 or more) stamens; by the fruit 10—10·5 cm. long, 6 cm. across, obovoid and very obsoletely trigonous, and very suddenly and shortly stoutly rostrate, and having 12 internal dissepiments; by the scales very acuminate, 1·5 mm. wide; and by the thickness of its pericarp, of which the mesocarp measures 7 mm. and the endocarp 3 mm.

Plate 118.—Eugeissona insignis *Becc.*—Entire flower-bearing branch; one middle sized fruit entire; vertical section through the seed of one of the largest fruits; the lower half of a fruit transversely cut. From Beccari's P. B. No. 2010.

6. Eugeissona major Becc. Malesia iii, 58.

Description.—*Fruit* large, 13 cm. long, 10 cm. across, ovoid, regularly circular in transverse section, almost equally broad at both ends, flattish at the base, very slightly depressed, and very suddenly contracted above into a broad, short and obtuse mammilliform rostrum, only about 12 mm. high. *Scales* extremely numerous, small (the largest 1·5 mm. broad at their bases) and slightly depressed or faintly grooved in their postcious part, and produced into lighter, elongate, acuminate apices. The pericarp is very thick, on the average 16—17 mm. in thickness in a transverse central section; the endocarp alone is 3 mm. thick; the cavity is divided very regularly into 12 incomplete dissepiments, of which the three principal penetrate very deeply, almost to the centre of the seed, and are obtusely bilobed in transverse section at their internal end, while three are somewhat shorter, and six smaller still. The *seed* is 6 cm. in diameter and marked by as many deep furrows as there are dissepiments. Other parts unknown.

Habitat.—Borneo, collected by *Teysmann* on the Kapuas.

Observations.—It is related to *E. insignis* from which it differs in its much larger and shorter rostrate fruit, but especially in its greatly thicker pericarp. Portions of leaves and some flowers (not referable to any one of the species of which these parts are known) collected by Hallier at Liang-gagang in Dutch Borneo, during the Expedition, 1893-94 (No. 2627 in Buitenzorg Herbarium) apparently belong to this species. The flowers and the leaves of *E. major* not being known, and Hallier's specimens wanting the fruit, a sure identification of these is, of course, impossible. It may even be that the *Eugeissona* of Liang-gagang belongs to a species distinct from *E. major*, and as yet undescribed.

Plate 115 (C.)—Eugeissona major *Becc.*—One of the fruits collected by Teysmann on the Kapuas; transverse median section of the same.

CONSPECTUS OF THE GENERA OF LEPIDOCARYEAE.

Lepidocaryeae verae.

Fruit covered with imbricating scales; mesocarp more or less fleshy; endocarp membranous and very thin.

I.—*Leaves pinnate, very rarely digitate or simply penninerved* (Gerontogeous).

+ DIOECIOUS PALMS.

A.—Funiform spinous palms, or if at times not climbing, allied to species that are so and with slender stems.

SUBTRIBE I.—CALAMEAE.—Leaf-sheaths, leaves and spadices, all or only one or two of these organs furnished with whip-like appendages (cirri or flagella) armed only with common spines or prickles, *i.e.*, "claws" (not with hook-like metamorphosed leaflets *i.e.*, "Acanthophylla").

⊙ *Polycarpic Palms.*

Gen. 1.—***Calamus.***—Spadices usually elongate, furnished with permanent tubular or infundibuliform spathes, at times tubular at their bases and split along, or even spread open higher up. Male spadix bearing the flowers in spikelets upon which the flowers are solitary at every spathel. Female spadix bearing spikelets upon which every female flower is accompanied with a neuter or rudimentary flower. Fruit monospermous, very rarely 3-spermous. Seed with homogeneous or ruminate albumen. *Southern Asia, Asiatic tropical Archipelagos, Papuasia, Africa, Australia.* Sp. 256.

Gen. 2.—***Daemonorops.***—Spadices abbreviate, enveloped by several broad cymbiform or laminar spathes, entirely or partly deciduous. Male and female flowers as in *Calamus.* Fruit always monospermous, seed always with ruminate albumen. *South-east tropical Asia and Asiatic tropical Archipelagos.* Sp. 91.

Gen. 3.—***Ceratolobus.***—Spadices abbreviate, having the male and female panicles closed into only one permanent indehiscent spathe pervious only at its apex, similar in both sexes. Male and female flowers as in *Daemonorops.* Fruit always monospermous. Seed ruminate. *Malay Peninsula and Western Malayan Islands.* Sp. 6.

Gen. 4.—**Calospatha.**—(Polycarpic ?). Female spadix (or one of its partial inflorescences ?) very short, bearing the flowers in short spikelets in the axils of large distichous imbricating thinly coriaceous more or less pinous spathes. Flowers as in *Daemonorops*? Fruit 2—3-spermous Seed with homogeneous albumen. *Malay Peninsula.* Sp. 1.

⊙⊙ *Mo nocarpic Palms.*

Gen. 5.—**Plectocomia.**—Spadices similar in both sexes, divided into several long pendulous branches, furnished with numerous uniform distichous imbricating persistent unarmed spathels, which cover short spikelets. Male flowers in pairs. Female flowers fewer and larger than the male ones, and solitary at each notch of the spikelet-axis. Fruit usually monospermous. Seed with homogeneous albumen. *N.-E. India, South-eastern tropical Asia, Malay Archipelago. Philippines.* Sp. 12.

Gen. 6.—**Plectocomiopsis.**—Spadices considerably different in the two sexes, but having similar small tubular or infundibuliform secondary spathes. Male flowers approximate in small spikelets. Female flowers 2—3, equal in the axils of secondary spathes and having the ovary entirely enclosed in an urceolum formed by the staminodes. Fruit covered with very small scales, but distinctly arranged in numerous vertical series. Fruit monospermous. Seed with homogeneous albumen. *Malay Peninsula, Western Malayan Islands, Cochin-China.* Sp. 5.

Gen. 7.—**Myrialepis.**—Spadices very dissimilar in the two sexes. Secondary spathes small, tubular-infundibuliform; flower-spikelets scorpioid and few-flowered, but very dissimilar in the two sexes. Female flowers with a short cupular 6-toothed nectarium, formed by the sterile stamens. Fruit monospermous, covered with innumerable extremely minute scales not regularly arranged in vertical series. Seed with homogeneous albumen. *Malay Peninsula, Sumatra.* Sp. 1.

B.—Short stemmed and tufted or arboreous and never climbing Palms.

Subtribe II.—Zalacceae.—Tufted and almost stemless or arboreous, more or less spinous, devoid of any kind of flagelliform or whip-like appendages. Flowers pluriseriate and approximate in very compact spikes. Spadices axillary, considerably shorter than the leaves.

* Gen. 8.—***Zalacella.***—Small, tufted. Spadix slender, rigid. Spathes tubular, closely sheathing. Female flowers spicate, closely packed, arranged in six series on a cylindraceous axis. The flowers are apparently 3-nate but only the centre one fertile. Fruit very small, calamoid. Imperfectly known and of a somewhat uncertain position. *Cochin-China.* Sp. 1.

Gen. 9.—***Zalacca.***—Tufted, almost stemless. Spadices very different in the two sexes. Male flowers in pairs at each spathel. Female flower considerably larger than the male ones; ovary 3-locular. Fruit large, mostly 3-spermous, but at times monospermous. Seeds large with homogeneous albumen. *Eastern India, Siam, Malay Archipelago, Philippines.* Sp. 13.

Gen. 10.—***Pigafetta.***—Arboreous; spadices composed of very many slender spikes, not much dissimilar in the two sexes. Male flowers very small, geminate, protected by extremely minute bracteoles. Female flowers small, nestling in the wool of some bracteoles; ovary unilocular, with three ovules. Fruit very small monospermous, calamoid. Seed with equable albumen. *Eastern Malay Archipelago, Indo-China, and Papuan Islands.* Sp. 1.

++ Monoecious and arboreous Palms.

Subtribe III.—Raphieae.—Ultimate divisions of the spadix consisting of spiciform flower-bearing branchlets, bearing at every spathel in their lower part solitary female flowers, and upwards male flowers only; the latter dissimilar from the female. Fruit large, monospermous. Seed ruminate.

Gen. 11.—***Raphia.***—*Tropical Africa and Madagascar. One in littoral equatorial America.* Sp. 20.

Subtribe IV.—Metroxyleae.—Ultimate divisions of the spadix consisting in spike-bearing branches. Spikes amentiform, bearing at every spathel two flowers, externally equal, one of which, however, is a male and the other a female, the latter opening after the fall of all the males. Fruit globular, normally monospermous. Seed globose, having a very large and deep chalazal fovea in its upper part, homogeneous albumen and a basal embryo.

Gen. 12.—***Metroxylon.***—*Malayan Islands, Philippines Papuasia and Polynesia.* Sp. 9.

* The genus *Zalacella* Becc. was proposed for Calamus Harmandi *Pierre* and a description of that palm was given in Ann. Roy. Bot. Gard. Calc., xi, 496, accompanied by t. 229 representing the type specimen. [Editor.]

+ + + Hermaphrodite. Calamoid Palms.

Subtribe V.—Korthalsieae.—Ultimate divisions of the spadix bearing amenti form spikes. Flowers solitary at every spathel and of one kind only. Leaves of the adult plant cirriferous, the cirri armed with usual claws only. Fruit small. Seed ruminate or homegeneous.

Gen. 13.—***Korthalsia.***—*Malay Peninsula and Western Islands of the Malay Archipelago, Celebes, the Philippines, New Guinea.* Sp. 26.

Subtribe VI.—Ancistrophylleae.—Leaves having the rhachis prolonged into a filament armed with abortive leaflets transformed into hooks (acanthophylla). Flowers of one kind only.

Gen. 14.—***Ancistrophyllum.***—Spadix panicled, terminal, much branched ; branches furnished with infundibular spathels. Flowers coriackous ; in pairs at each spathel. *Tropical Africa.* Sp. 4.

Gen. 15.—***Oncocalamus.***—Spadices panicled, lateral the main branches sheathed by tubular spathes. Flower-bearing branches tail-like, furnished with approximate spathels, each protecting a glomerule of flowers. *Tropical Africa.* Sp. 1.

Gen. 16.—***Eremospatha.***—Spadix axillary, short, simply branched, not having spathes, but only scale-like bracts at the base of every flowerbearing branch. Flowers fleshy, in pairs on the branches, naked, *i.e.*, not protected by spathels ; the two flowers exactly alike. *Tropical Africa.* Sp. 8.

II.—*Leaves palmatified or palmatinerved. Polycarpic dioecious Palms.* (Neogeae).

Subtribe VII.—Mauritiae.—Arboreous or fruticose, having slender erect stems. Spadix with tubular or infundibuliform primary and secondary spathes. Fruit monospermous. Seed with equable albumen.

Gen. 17.—***Lepidocaryum.***—Small non-spinous palms. Stem slender, erect. Leaves bipartite or palmatipartite. Spadices small, dioecious, male and female similar. Male and female flowers similar, distichous on spikelets coming forth from the axils of infundibular or sheathing spathes. Flowers coriaceous, elongate. Male flowers solitary or in pairs at each spathel, having six stamens. Female flowers solitary, at each spathel, having also six stamens, well evolute but sterile. Fruit as in *Calamus.* *Tropical America.* Sp. 7.

Gen. 18.—**Mauritia.**—Arboreous. Leaves flabellate, divided in two principal parts, simply multified. Spadices paniculate, divided into several spike-bearing branches. Male flowers pluriseriate and crowded in small spikelets, solitary or in pairs at each spathel. Stamens six ; rudimentary ovary extremely minute. Female flowers larger than the male ones, and fewer on shorter spikelets ; the calyx cupular, the corolla entire and ventricose in its lower part, 3-parted above. Staminodes six, conspicuous, forming a ring at the throat of the corolla ; anthers abortive. Ovary globular-ovoid ; stigmata short, connivent. Seed appendiculate in its uppermost part ; embryo ventral. *Tropical America.* Sp. 11.

Lepidocaryeae spuriae.

Fruit covered with inmumerable scales ; mesocarp dry, fibrous ; endocarp thick woody, pervious at its base.

SUBTRIBE VIII.—EUGEISSONEAE.—Arboreous or caespitose spinous monocarpic palms having pinnate leaves, and large coriaceous hermaphrodite dichogamous pluristaminate non-spicate flowers. Fruit monospermous, clothed with inmumerable very minute scales ; pericarp dry, fibrous ; endocarp thick, woody, pervious at its base ; the endocarpal cavity divided by 6-12 incomplete dissepiments. Seed plurisulcate, having homogeneous bony albumen and a basal embryo.

Eugeissona. *Malay Peninsula and Borneo solely.* Sp. 6.

Lepidocarycae extra-asiaticae.

RAPHIA Palis de Beauv.

Palis. de Beauv. Fl. Ow. et Benin, i, 75 t. 44, f. 1 et t. 45. 46 ; Mart. Hist. Nat. Palm. ii, 53. t. 45 f. 5. et t. 48 (*Sagus*) iii, 216.343 ; Drude in Mart, Fl. Bras. iii, II. 286, t. 61.62, et in Engl. Jahrb. xxi, (1895) 111 ; Mann. et Wendl. in Trans. Linn. Soc. xxiv, 437. t. 39. A. B. et t. 42 A. B. C. D ; Benth. et Hook. f. Gen. Plant. iii, 935 ; Wright in Th. Dyer. Fl. Trop. Afr. viii, (1902) 104 ; Becc. in Agricolt. Colon. iv, (1910) t. 1—6, and in Webbia, iii, (1910) 37, f. 1—8.

KEY TO THE SPECIES.

A. Male flowers very dissimilar to the female ones.

I.—*The corolla of the female flowers shorter than the calyx and entirely hidden by it.*

* Spikes strongly flattened, bearing exactly bifarious, very approximate male and female flowers. Male flowers about 6 mm. long, having 6 to 9 stamens.

(*a*) Fruit turbinate or nearly globular, slightly longer than broad (4·5—6·5 × 3·5—4·5 cm.) rounded or slightly attenuate at the base.

1. ***Raphia Ruffia*** (type) Mart.

Fruit smaller, distinctly turbinate narrowing downwards to a rather acute base.

R. Ruffia VAR ***pedunculata*** Becc.

(*b*) Fruit oblong, at least twice as long as broad.
Fruit 8—10 cm. long, 3—4·8 cm. across.

2. ***R. Kirkii*** Engl.

Fruit long and narrow, 11—13 cm. long, 3—5·5 cm. across.

R. Kirkii VAR. ***longicarpa*** Becc.

Fruit ovoid-elliptical, 8—12 cm. long, 4—4·5 cm. across.

R. Kirkii VAR. ***grandis*** Becc.

** Spikes more or less flattened, the flowers sub-4-seriate, more rarely loosely but nearly exactly biseriate.

(*a*) Male flowers 25—26 mm. long. stamens 16. Fruit large, oblong-ovoid, 76—82 mm. long, 37-39 mm. broad.

3. ***R. longiflora*** Mann et Wendl.

(*b*) Male flowers 17 mm. long, stamens usually 12. Fruit small, ovoid or subobovoid, 5·5 cm. long, 3·3 cm. broad.

4. ***R. Laurentii*** De Wild.

II.—*Female flowers having the corolla more or less protruding beyond the calyx, at least with the apices of its divisions.*

* Fruit having the scales strongly convex and bigibbous in the posticous part, and flattish, depressed or slightly concave anticously.

(*a*) Fruit obovoid having an asymmetrical base (always). Seed ruminate from numerous narrow and deep intrusions of the integument.

5. ***R. Mannii*** Becc.

(*b*) Fruit broadly obovoid-turbinate, the base acute and symmetrical. Seed ruminate from few intrusions of the integuments broadening in its central part.

6. ***R. textilis*** Welw.

** Fruit having the scales regularly convex from base to apex and more or less grooved along the middle.

§ Fruit ovoid-elliptical, equally rounded or equally more or less attenuate at both ends.

† Female flowers having the calyx truncate at the mouth or very obsoletely 3-toothed.

(*a*) Fruit ovoid-elliptical. very shortly beaked, otherwise rounded at both ends, 5—5·5 cm. long, 3·3—3·5 cm. broad.

7. ***R. taedigera*** Mart.

(*b*) Fruit elliptical, narrowing at both ends, long and very acutely beaked, smaller than in *R. taedigera*, 14·2 mm. long, including the beak, 22 mm broad.

8. ***R. Wendlandi*** Becc.

†† Female flowers having the calyx more or less deeply 3-toothed or 3-lobed.

(*a*) Female flower having the corolla considerably longer than the calyx. Fruit elongate-ellipsoidal, 7·5—8 cm. long, 3—3·5 cm. broad, gradually rather long-beaked.

9. ***R. Gaertnerii*** Mann et Wendl.

(*b*) Female flower having the corolla considerably longer than the calyx. Fruit ovoid-elliptical, rounded at both ends, 6—6·5 cm. long, 3·3—3·5 cm. broad, shortly and very suddenly beaked.

10. ***R. vinifera*** Palis. de Beauv.

(*c*) Female flower having the corolla very slightly longer than the calyx. Fruit ellipsoidal, very abruptly narrowing at both ends, shortly and minutely beaked, 5·5—6 cm. long, 2·5—2·7 cm. broad.

11. ***R. gracilis*** Becc.

§§. Fruit turbinate or attenuate at the base more than above.

† Fruit large, 8—8·5 cm. long, 4—4·5 cm. broad, obovoid, terminated by a thick subcylindrical blunt beak.

12. ***R. heberostris*** Becc.

†† Fruit small, terminated by a short slender acute beak.

(*a*) Male flower having the calyx deeply 3-toothed. Fruit 45 mm. long, 18 mm. broad.

13. ***R. Monbuttorum*** Drude.

(*b*) Male flower having the calyx truncate. Female flowers having 6 staminodia, subulate and free from their bases. Fruit 5—6·5 cm. long, 3—3·5 cm. broad, rounded above, attenuate below, and with the base acute.

14. ***R. Gentiliana*** De Wild.

(*c*) Male flower having the calyx truncate. Female flowers having the staminodia connate by their bases, 3 of which are subulate. and the other 3 bifid. Fruit very small, obovoid attenuate at the base, 4—4·5 cm. long, 21—22 m. broad.

15. ***R. Gilletii*** Beac.

††† Fruit amongst the largest, terminated by a stout, acute or acuminate beak.

⊙ Beak of the fruit narrowly conical, gradually attenuate at apex. Fruit oblong-clavate, 10—11 cm. long (including the beak) and 3·5—4·3 cm. broad in its upper part, the beak alone 15—17 mm. long.

16. ***R. longirostris*** Becc.

⊙⊙ Beak of the fruit stout, trigonous, acuminate.

△ Male flowers having 18—20 stamens, their filaments mostly united to form a fleshy body (in *R. angolensis* the male flowers unknown).

□ Fruit not more than 8—10 cm. long.

a. Fruit broadly oblong, 8—10 cm. long (including the beak), 4—4·5 cm. broad, the beak alone 14—15 mm. long; the largest scales 2 cm. broad.

17. ***R. Hookeri*** (forma typica) Mann et Wendl.

b. Fruit smaller than in *a*, obovoid, 6—7 cm. long (including the beak) 3·2—3·5 broad; the beak 12 mm. long.

R. Hookeri VAR. ***brachycarpa*** Becc.

c. Fruit oblong-clavate, 8 cm. long (including the beak), 3 cm. broad; the beak 1 cm. long; scales narrower than in *a*, very faintly and narrowly grooved.

R. Hookeri VAR. ***mancipiorum*** Becc.

d. Fruit narrow, clavate, long-attenuate at the base, 7·5 cm. long (including the beak), 2·5 cm. broad in its upper part; the beak 11 mm. long; scales narrower than in type, not or obsoletely grooved.

R. Hookeri VAR. ***angustata*** Becc.

□ Fruit elongate, oblong-clavate, 12 cm. long (including the beak), 38 mm. broad in its upper part, rounded above and very suddenly long-beaked; the largest scales 2 cm. broad; seed 7 cm. long, 2·5 cm. broad terete, rounded above.

18. ***R. angolensis*** Randle

△△ Male flowers having 30 and more biseriate stamens. Fruit subobovate, 8—9 cm. long (including the beak), 3·8—4 cm. broad, the beak stout, 12—15 mm. long.

19. ***R. Sese*** De Wild.

B. Male flowers very similar to the female ones.

A large palm producing an immense erect inflorescence, divided into long pendulous floriferous branchlets; spikes strongly flattened, having the male and female flowers very closely and regularly bifarious.

20. ***R. regalis*** Becc.

1. RAPHIA RUFFIA Mart. Hist. Nat. Palm. iii, 217; Becc. in Agric. Colon. iv. (1910) t. 1. and in Webbia iii, (1910) 47, f. 1. and Palme del Madag. 55, and the figure on the title page.

R. lyciosa and *R. polymita* Comm. ex Kunth, Enum. Pl. iii, 217.

R. tamatawensis Sadebeck in Engl. Bot. Jahrb. xxxvi, (1905) 354.

Madagascar, especially on the West coast.

RAPHIA RUFFIA Mart. *var* PEDUNCULATA Becc. in Webbia, l. c. 56, f. 2 and in Agric. Colon. l. c. t. I, f. 6.

R. pedunculata P. Beauv. in Desv. Journ. Bot. ii, 87 and Fl. Oware et Benin i, 78, t. 44, f. 2. and t. 46, f. 2.

Madagascar. East coast ?

2. RAPHIA KIRKII Engl. Pflanzenw. Ost-Afr. A (1895) 10; Becc. Agric. Colon. l. c. t. II, f. 1-2 and in Webbia l. c. 58.

R. eximia Damm. in Sadebeck in Engl. Bot. Jahrb. xxxvi (1905), 370, f. 12 A.

S. E. Tropical Africa.

RAPHIA KIRKII *var.* LONGICARPA Becc. in Agric. Colon. l. c. t. II, f. 3—4. and in Webbia l. c. 63.

S. E. Tropical Africa. Ukamba, Pangani River and Zanzibar.

RAPHIA KIRKII *var.* GRANDIS Becc. in Agric. Colon. l. c. t. II, f. 5—6, and in Webbia l. c. 64.

S. E. Tropical Africa. Nyasaland and Zanzibar.

3. RAPHIA LONGIFLORA Mann et Wendl. in Trans. Linn. Soc. xxiv, 438, t. 39, f. A and t. 42, f. E; Becc. in Webbia l. c. 66, fig. 7, II, *a*, *b*.

The Island of Corisco in the Gulf of Guinea.

4. RAPHIA LAURENTII De Wild. Miss. E. Laurent i, 26, t. VII. VIII. IX. X. and f. 6; Becc. in Webbia, l. c. 68 p. 6 V. *a*. *b*.

Lower Belgian Congo at Eala.

5. RAPHIA MANNII Becc. in Agric. Colon., iv, (1910), t. VI, f. 8—9, and in Webbia, l. c. 70, f. 8. II *a*, *b*, *c*.

West Tropical Africa. Old Calabar River.

6. RAPHIA TEXTILIS Welw. Apont. 584 (1858) et Synopse expl. etc. (1862), 39; Becc. in Agric. Colon. iv, (1910) t. III, f. 1, 2, 3, and in Webbia, l. c. 73, f. 8, III, *a*, *b*.

R. Welwitschii Wendl. in Trans. Linn. Soc., xxiv (1863), 439, t. 42, f. B.

Lower Guinea at Angola.

7. RAPHIA TAEDIGERA Mart. Hist. Nat. Palm. iii, 216; Becc. in Agric. Colon. v (1910), t. VI, f. 2—3 and f. 3 in the text, and in Webbia, l. c. 75 f. 3.

Brasil. Littoral region of the Amazon.

8. RAPHIA WENDLANDI Becc. in Agric. Colon. l. c. t. VI. f. 10—11 and in Webbia, l. c. 81, f. 8. I, *a*, *b*, *c*.

Island of Fernando Po in the Gulf of Guinea.

9. RAPHIA GAERTNERII Mann et Wendl. in Trans. Linn. Soc. xxiv, 437 (partly) Becc. in Webbia, l. c. 84, f. 4.
Liberia.

10. RAPHIA VINIFERA Palis. de Beauv. in Desv. Journ. Bot. ii (1809), 87 et Fl. d'Oware et Benin, ix, 77, t. 44, f. 1 et p. 45 (excl. syn. Gaertn.) et t. 46, f. 1. *a*, *b*, *c*.; Becc. in Webbia, l. c. 88. f. 3, and in Agric. Colon. t. VI. f. 1—7,
Lower Nigeria.

11. RAPHIA GRACILIS Becc. in Agric. Colon. l. c. t. V, f. 7, 8 and in Webbia; l. c. 92, f. 6, I. a.
French Guinea and Sierra Leone.

12. RAPHIA HEBEROSTRIS Becc. in Agric. Colon. l. c. t. V. f. 3—6 and in Webbia, l. c. 96.
Senegal and Dahomey.

13. RAPHIA MONBUTTORUM Drude in Engl. Jahrb. XXI (1895) 111.130; Becc. in Agric. Colon. l. c. t. VI, f. 1, and in Webbia, l. c. 98. f. 6 II. *a*, *b*.

Central Equatorial Africa, Monbuttu, and at Okël in Djur.

14. RAPHIA GENTILIANA—De Wild. Miss. Laurent, 28, t. XIII. XIV; Becc. in Webbia, l. c. 102, f. 5. III, *a*. *b*, *c*.

Lower Belgian Congo, Eala.

15. RAPHIA GILLETII Becc. in Webbia, l. c. 105 f. 6, IV, *a*, *b*.

R. Gentiliana VAR. *Gilletii* De Wild. Miss. Laurent, 30, t. XV.

Lower Belgian Congo.

16. RAPHIA LONGIROSTRIS Becc. in Agric. Colon. l. c. t. V, f. 1, 2 and in Webbia, l. c. 108(*).
Liberia.

17. RAPHIA HOOKERI Mann. et Wendl, in Trans. Linn. Soc. xxx (1863), 438, t. 39, f. B and t. 42, f. A; Becc. in Agric. Colon, l. c. t. III, f. 5, 6 and t. IV, f. 1—4, and in Webbia, l. c. 109, f. 7, III *a*. *b*.

British Guinea, French Congo and Old Calabar.

RAPHIA HOOKERI *var.* BRACHYCARPA Becc. in Agric. Colon. l. c. t. IV, f. 5, and in Webbia, l. c. 115.

Gold Coast.

* In Webbia l. c. the quotations of the figures of this species in Agr. Colon. are erroneously indicated 3—6 instead of 1—2.

RAPHIA HOOKERI *var.* ANGUSTATA Becc. in Agric. Colon. l. c. t. III, f. 7, and in Webbia, l. c. 116.

Interior West Africa.

RAPHIA HOOKERI *var.* MANCIPIORUM Becc. in Agric. Colon. l. c. t. IV, f. 6, and in Webbia, l. c. 117.

Gold Coast and Slave Coast.

18. RAPHIA ANGOLENSIS Rendle in Hiern and Rendle Cat. Afr. Pl. Welw. ii, 83; Becc. in Agric. Colon. l. c. t. III, f. 4 and in Webbia, l. c. 119.

Lower Portuguese Guinea, Angola.

19. RAPHIA SESE De Wild. Miss. Laurent, 28. t. XI, XII; Becc. in Webbia, l. c. f. 7 I, *a*, *b*.

Lower Belgian Congo.

20. RAPHIA REGALIS Becc. in Webbia, l. c. 125 t. I.

Near Nschaggebod in French Congo.

DOUBTFUL SPECIES.

RAPHIA MAXIMA Pechuel Loesche, Loango Expedition iii, 164. Becc. in Webbia, l. c. 127 (=*R. Hookeri* Mann et Wendl.)

West Africa at Yumba, Loango Coast, in French Congo.

Ancistrophyllum *Mann et Wendl.*

Mann et Wendl. in Kerch. Les Palm. 230 et in Trans. Linn. Soc. xxiv, 432, t. 38 D, 41 G, 43 C (*Calami* subgenus); Benth. et Hook. f. Gen. Pl. iii, 937; Wright in Th. Dyer Fl. Trop. Afr. viii, (1902), 113; Becc. in Webbia, iii, (1910), 249. *Laccosperma* Mann et Wendl. in Kerch. Les Palm. 249.

KEY TO THE SPECIES.

A. Leaflets elongate, more or less sigmoid or at least with falcate apices, having 1—2 main nerves ciliate-spinulous on the upper surface.

Flowers cylindraceous, very suddenly obsoletely apiculate. Seed smooth, flattish on the raphal side.

1. ***A. secundiflorum*** Wendl.

Flowers fusiform acuminate. Seed smooth, concave on the raphal side.

2. ***A. acutiflorum*** Becc.

B. Leaflets sigmoidal, with 1 or more main nerves smooth on the upper surface.

Leaflets very unequal and inequidistant or nearly grouped, short, 2—3 or up to 6—9 cm. broad, having 1—4 main nerves, the margins ciliate spinulous. Flowers thickly fusiform, acute seed boldly tubercled, deeply excavate on the raphal side.

3. ***A. opacum*** Wendl.

Leaflets inequidistant or nearly grouped, elongate-sigmoidal or falciform, 3—4, cm. broad, mostly 2-costulate or at times 1-costulate, the margins smooth. Flowers narrowly fusiform, acuminate.

4. ***A. laeve*** Wendl.

1. ANCISTROPHYLLUM SECUNDIFLORUM Wendl. in Kerch. Les Palm. 230; Becc. in Webbia, l. c. 251.

Calamus secundiflorus Palis. Beauv. Fl. Oware et Benin, i, 15, t. g—10. c. (*Ancistrophyllum*) *secundiflorus* Mann et Wendl. in Trans. Linn. Soc. xxiv, 432, t. 38, f. D, t. 41. f. G, t. 43, f. C.

The littoral regions bordering the Gulf of Guinea from Sierra Leone to the Lower Belgian Congo, and perhaps also to Angola.

2. ANCISTROPHYLLUM ACUTIFLORUM Becc. in Webbia l. c. 255.

Cameroons, French Congo and Portuguese Guinea.

3. ANCISTROPHYLLUM OPACUM Drude in Engl. Bot. Jahrb. xvi, iii; Becc. in Webbia, l. c. 257.

Calamus (*Laccosperma*) *opacus* Mann et Wendl. in Trans. Linn. Soc. xxiv, 431, t. 41, f. D et t. 43, f. D.

Laccosperma opacum Wendl. in Kerch. Les Palm. 249, and in Bot. Zeit, 1877, t. v. f. 3, 4, 5.

Fernando Po, Ashanti, Cameroons, Spanish Guinea, and at Fort Boni in the Ruwenzori Region.

4. ANCISTROPHYLLUM LAEVE Drude in Engl. Bot. Jahrb. xxi, 111; Becc. in Webbia, l. c. 261.

Calamus (*Laccosperma*) *laevis* Mann et Wendl. in Trans. Linn. Soc. xxiv, 430. t. 38, f. B.

Laccosperma laeve Wendl. in Kerch. Les Palm. 249.

Gaboon River.

ONCOCALAMUS Mann et Wendl.

Mann et Wendl. in Kerch. Les Palm. 252 et in Trans. Linn. Soc. xxiv, 436, t. 41 E et t. 43 E (*Calami* Subg.) Benth. et Hook. f. Gen. Pl. iii, 936; Wright in Th. Dyer. Fl. Trop. Afr. viii, 110; Drude in Engl. Bot. Jahrb. xxi, (1895) 111; Becc. in Webbia, iii, (1910) 264.

ONCOCALAMUS MANNII Drude in Engl. Bot. Jahrb. xxi, (1895) 111; Becc. in Webbia, l. c. 265.

Calamus (*Oncocalamus*) *Mannii* Wendl. in Trans. Linn. Soc. xxiv (1863) 436.

Gaboon River, Cameroons.

EXCLUDED SPECIES.

ONCOCALAMUS ACANTHOCNEMIS Drude in Engl. Bot. Jahrb. xxi (1895) 111 and 133; Becc. in Webbia, l. c. 269.

Established on young leaves, apparently belonging to more than one species.

EREMOSPATHA Mann et Wendl.

Mann et Wendl. in Kerch., Les Palm. 252 et in Trans. Linn. Soc. xxiv, 433, t. 41 A. B. C. et t. 43 B (*Calami* Subg.) Benth. et Hook. f. Gen. Plant. iii, 936; Wright in Th. Dyer, Fl. Trop. Africa, viii, 111; Drude in Engl. Bot. Jahrb. xxi, (1895) 111; Becc. in Webbia, iii (1910) 270.

KEY TO THE SPECIES.

A. Leaflets narrow, linear or linear-lanceolate.

Leaflets about 23 on each side of the rhachis, acute or bluntish, or at times præmorse-toothed at the apex; the margins ciliate-spinulous, the spinules pointing upwards; secondary nerves 5—6 on each side of the mid-costa.

1. ***E. macrocarpa*** Wendl.

Leaflets 25—27 on each side of the mid-costa, subequidistant, suddenly apiculate-cuspidate at apex; the margins ciliate-spinulous, the spinules pointing upwards; secondary nerves 5—6 on each side of the mid-costa.

2. ***E. cuspidata*** Wendl.

Leaflets 7—8 on each side of the mid-costa, suddenly terminating in a bluntish spinulous apiculum; the margins closely and strongly ciliate-spinulous, the spinules always pointing downwards; secondary nerves two on each side of the rhachis.

3. ***E. Teysmanniana*** Becc.

Leaflets about 15 on each side of the rhachis, very unequidistant, having 5 equally strong costae; the margins nearly smooth; the cirrus armed with prickles on the margins at the sides, up to the apex, amongst the acanthophylla.

4. ***E. quinquecostulata*** Becc.

B. Leaflets ovate, ovate oblong, spathulate, rhomboidal or cuneate.

* Leaflets green on both surfaces.

Leaflets ovate, obovate, obovate-elliptical or ovate-subrhomboidal, 12—14 on each side of the rhachis, alternate and subequidistant; the margins ciliate-spinulous; tranverse veinlets 1—2 mm. apart; branchlets of the spadix and flowers papillosetomentose.

5. ***E. Hookeri*** Wendl.

Leaflets obovate-oblong or oblong spathulate, cuneate at base, unequidistant, 6—9 (at times in pairs) on each side of the rhachis; the margins ciliate-spinulous; transverse veinlets 1—2 mm. apart; branchlets of the spadix and flowers glabrous.

6. ***E. Haullevilleana*** De Wild.

Leaflets broadly rhomboidal or trapezoidal, not numerous (7—8? on each side of the rhachis), remotely alternate, equidistant; the margins in the lower part of the blade smooth or very sparingly ciliate-spinulous; transverse veinlets very crowded, sharp and parallel, 0·3—0·5 mm. apart.

7. ***E. Wendlandiana*** Damm.

* * Leaflets mealy-pulverous underneath.

Leaves large, 1·20 m. long in the pinniferous part. Leaflets 9—10 on each side of the rhachis, plicate-pluricostulate, triangular in their upper third and thence gradually cuneate or narrowed to the base; the margins smooth or spinulous; the largest leaflets 30—35 cm. long and 14—18 cm. broad in their upper part.

8. ***E. Korthalsiaefolia*** Becc.

1. EREMOSPATHA MACROCARPA Wendl. in Kerch. Les Palm. 244; Becc. in Webbia, iii (1910) 272.

Calamus (*Eremospatha*) *macrocarpa* Mann et Wendl. in Trans. Linn. Soc. xxiv, (1863), 435.

Sierra Leone, Old Calabar River, Cameroons.

2. EREMOSPATHA CUSPIDATA Wendl. in Kerch. Les Palm. 244; Becc. in Webbia, l. c. 275.

Calamus (*Eremospatha*) *cuspidatus* Mann et Wendl. in Trans. Linn. Soc. xxiv, 434, t. 41. f. B.

Gaboon River and Joko in Cameroons.

3. EREMOSPATHA TEYSMANNIANA Becc. in Webbia, l. c. 278.

French Congo or Spanish Guinea.

4. EREMOSPATHA QUINQUECOSTULATA Becc. in Webbia, l. c. 279.

Cameroons, District of Djah.

5. EREMOSPATHA HOOKERI Wendl. in Kerch. Les Palm. 244; Becc. in Webbia, l. c. 281.

E. Cabrae De Wild. Étud. Fl. du Congo, i, 95. t. XXXII.

Calamus (*Eremospatha*) *Hookeri* Mann et Wendl. in Trans. Linn. Soc. xxiv (1863), 434, t. XLI, C.

River Nun, Cameroons, and Ogowé.

6. EREMOSPATHA HAULLEVILLEANA De Wild. Ét. Fl. du Congo, i, 96, t. XXXIII-XXXIV et Miss. Laurent, 24; Becc. in Webbia, l. c. 285.

E. Schweinfurthii Becc. in Ann. Roy. Bot. Gard. Calc. xi, 164.

Lower Belgian Congo at Lubamba, at Kisantu, etc., and at Kambele in the Monbuttu country.

7. EREMOSPATHA WENDLANDIANA Dammer, nomen in Herb. Ber.; Becc. in Webbia, l. c. 290.

Barombi-Station in the Cameroons.

8. EREMOSPATHA KORTHALSIAEFOLIA Becc. in Webbia, l. c. 292.

Elbolowa in the Cameroons.

LEPIDOCARYUM Mart.

Mart. Hist. Nat. Palm. ii, 49, t. 47, f. 1—3 ; Benth. et Hook. f. Gen. Pl. iii, 938 ; Drude in Mart. Fl. Bras. iii, ii, 29. t. 62, 67, 68 ; Spruce in Journ. Linn. Soc. xi, 172.

Mauritia Sect. *Lepidocaryum* Trail in Trim. Journ. of Bot. 1877, 129 ; Barb. Rodr. Enum. Palm. Nov. 19, and Sertum Palm. i, 10, t. 4.

KEY TO THE SPECIES.

A. Leaves divided into two principal segments, these entire or divided again ; the segments are 4—6, rarely up to 8—9, in all.

* Leaves divided into 2—6 segments.

† Fruit 20—23 mm. long.

Spadix divided into 2—3 flower-bearing branches only. Secondary spathes fugaciously rusty-furfuraceous. Flowers relatively large ; the male flowers 8—11 mm. long, 3 mm. broad ; the female 12—13 mm. long.
1. ***L. gracile*** Mart.

Spadix divided into several (about 7 in all) alternately distichous flower-bearing branches. Secondary spathes distinctly tomentose. Male flowers . . . . Female flowers 7 mm. long, Seed obsoletely apiculate, having a slightly depressed line along the raphal side.
2. ***L. tenue*** Mart.

Spadix divided into several alternate (4—8 on each side) flower-bearing branches ; secondary spathes fugaciously scaly-furfuraceous and finally glabrous. Male flowers 5—6 mm. long. Female flowers 7 long. Fruit cylindraceous-oblong (22—23 mm. long, 13—14 mm. across). Seed subterete, slightly emarginate above, deeply grooved longitudinally.
3. ***L. gujanense*** Becc.

†† Fruit larger than in the preceding species, 38 mm. long, 14 mm. in diam. Seed 23 m. long and 11 mm. in diam. (in Drude's figure).
4. ***L. macrocarpum*** (Drude) Becc.

** Leaves divided into several (8—9 at most) narrow segments. Flower-bearing branches 4 on each side of the main axis ; secondary spathes fugaciously rusty-furfuraceous. Male flowers very small (4 mm. long). Female flowers 6 mm. long Fruit ovoid-elliptical, equally rounded at both ends. 20—22 mm. long, 13 mm. across. Seed having a broad not deep depression along the raphal side and with an apical papilla.
5. ***L. enneaphyllum*** Barb. Rodr.

B. Leaves regularly palmate-flabelliform. Segments numerous, uniform.

Leaflets 16—20. broadly lanceolate, bluntish. Female spadix twice branched.

6. ***L. casiquiarense*** Spruce.

Leaflets 20, narrowly lanceolate. Female spadix simply divided into very few (3) flower-bearing branches. A smaller plant than the preceding.

7. ***L. guainiense*** Spruce.

1. LEPIDOCARYUM GRACILE Mart. Hist. Nat. Palm. ii, 50, t. 45, 46; Drude in Mart. Fl. Bras. iii, II, 299 t. Z LXII f. IX (f. $\frac{4}{1}$ excl. f. magn. nat.) et t. LXVII, f. 1.

Brasil, Japurā River (Prov. Rio Negro).

2. LEPIDOCARYUM TENUE Mart. Hist. Nat. Palm. ii, 51 t. 47; Wallace, Palm-trees Amazon, 61, t. II, f. 4 and t. XXII; Drude in Mart. Fl. Brasil iii, II, 298 (partly ?) t. LXII, f. VII (fruit) and excl. *L. enneaphyllum* Barb. Rodr.

Mauritia (*Lepid.*) *quadripartita* Spruce in Journ. Linn. Soc. xi, (Botany) 1869, 172 ex Drude l. c.

L. sexpartitum Barb. Rodr. Enum. Palm. Nov. 19, and Sertum Palm. i, 11. t. IV, f. B.

L. sexpartitum β microcarpum Drude l. c. 299, t. LXII. f. VIII (the fruit entire only and excluding the figure of the seed).

Brasil, Rio Madeira.

3. LEPIDOCARYUM GUJANENSE Becc. sp. n.

British Guiana (Schomburg No. 983 in the Berlin Herbarium).

Frondium segmentis 2—6, spadicis ramis floriferis alternis utrinque 4—8; spathis secundariis fugaciter furfuraceis; floribus masculis 5—6 mm. longis, floribus foemineis 7 mm. longis; fructibus oblongo-cylindraceis, 22—23 mm. longis, 13—14 mm. latis; semine subtereti, profunde longitudinaliter sulcato, apice vix emarginato.

4. LEPIDOCARYUM MACROCARPUM Becc.

L. sexpartitum var *macrocarpum* Drude in Mart. Fl. Bras. iii, II, 299, t. LXII, VIII (the seed only).

Brasil, Padaniri River (Trail No. 1095 in Kew Herbarium).

5. LEPIDOCARYUM ENNEAPHYLLUM Barb. Rodr. Enum. Palm. Nov. (1875) 19; Prot. app. 34; Les Palm. 10. t. 1, f. A. B. and Sertum Palm. i, 11, t. IV, f. A.

Brasil Rio, Trombetas and Jamunda.

6. LEPIDOCARYUM CASIQUIARENSE (sub *Mauritia*) Spruce in Journ. Linn. Soc. (Botany) xi (1896) 173; Drude in Mart. Fl. Brasil. iii, II, 300 t. LXII. f. XI (fruit).

South Venezuela, Casiquiari River.

7. LEPIDOCARYUM GUAINIENSE. Spruce (sub *Mauritia*), l. c. 174; Drude, l. c. 300. t. LXII, f. X (fruit) and t. LXVIII, 1.

South Venezuela, Guainia River.

UNRECOGNIZED SPECIES.

LEPIDOCARYUM TRISTICHUM Spruce ; mentioned by Barb. Rodr. in Sertum Palm. i, 11. (Spruce to my knowledge never published a *Lepidocaryum* with that specific name.)

A *Lepidocaryum* figured by Drude in Mart. Fl. Bras. iii, II, t. LXVIII, f. II, under the name of *L. tenue*, is probably a distinct species, owing to its female (or pseudo-hermaphrodite) flowers having stamens with short filaments and elongate linear anthers.

The genus *Lepidocaryum* is as yet very imperfectly known, and probably the species are more numerous than it is generally believed, although not offering conspicuous diagnostic characters.

MAURITIA Linn. f.

Linn. f. Suppl. 70 ; Mart. Hist. Nat. Palm. iii, 41, t. 38 ad 44, III, 344 ; Drude in Mart. Fl. Bras. iii, II, 287, t. 61 ad 65, 67 ; Wallace, Palm. Amaz. 46, t. 2, f. 2 et 17 ad 21 ; Barb. Rodr. Enum. Palm. Nov. 18, et Sertum Palm. i, 8. t. 2, 3 ; Spruce in Journ. Linn. Soc. xi, 167 ; Benth. et Hook. f. Gen. Plant. iii, 938.

Orophoma Drude in Mart. Fl. Bras. iii, II 294, t. 66.

KEY TO THE SPECIES.

A. Leaves green on both surfaces.

Fruit ovoid-elliptical.

1. ***M. vinifera*** Mart.

Fruit globular, depressed above.

2. ***M. flexuosa*** L.

B. Leaves white or waxy-pulverulent beneath.

* Leaflets having the margins and the mid-costa (on the upper surface) ciliate-spinulous. Female spikelets very short, having only two well evolute opposite flowers.

3. ***M. aculeata*** H. B. K.

* * Leaflets having the mid-costa smooth and the margins ciliate. Female spikelets 10—12 mm. long, bearing all round several flowers.

4. ***M. armata*** Mart.

* * * Leaflets having mid-costa and margins smooth.

Stem stout, solitary, unarmed ; the dead leaves remaining a long time hanging below the crown.

5. ***M. Carana*** Wallace.

Stem solitary spinescent. Spathes of the spike-bearing branches twice as long as broad.

6. ***M. Martiana*** Spruce.

Stem . . . . Spathes of the spike-bearing branches about as broad at the mouth as they are long.

7. ***M. peruviana*** Becc.

Stem slender, solitary, almost unarmed. Leaves having broad leaflets rather suddenly acute.

8. ***M. subinermis*** Spruce.

IMPERFECTLY KNOWN.

Slender. Stems in groups, spinescent. Leaves white beneath. Fruit ovate 5 × 4 cm. (Barb. Rodr.)

9. ***M. gracilis*** Wallace—Brasil, Amazon.

Stem solitary, slender 3 m. high, armed especially in its lower part with conical robust spines. Leaves having few rigid short and broad leaflets (colour underneath ?).

10. ***M. pumila*** Wallace—Upper Rio Negro.
11. ***M. setigera*** Gris.—Trinidad.

EXCLUDED SPECIES.

MAURITIA CARINATA Humb. in Spruce "Notes of a Bot. on the Amazon and Andes" [ed. by A. R. Wallace (1908) i, 368]. Evidently a slip of the pen for *M. aculeata* Humb.

MAURITIA PIRITA Linden in Illustr. Hort. 28. From the specific name it may be identified with *M. vinifera* Mart.

MAURITIA TENUIS Spruce . . . . = *Lepidocaryum tenue* Mart.

MAURITIA CASIQUIARENSIS Spruce . . = *Lepidocaryum casiquiarense.*

MAURITIA SAGUS Schult. (Quid.)

MAURITIA GRACILIS Spruce . . . . = *Lepidocaryum gracile.*

MAURITIA GUAINIENSIS Spruce . . . = *Lepidocaryum guainiense.*

1. MAURITIA VINIFERA Mart. Hist. Nat. Palm. ii, 42, t, 38 et 39, f. I. 1—22 et iii, 344 : Palm. Orbign. t. 13, 21 ; Drude in Mart. Fl. Bras. iii, II. 291, t. LXII, f. III.

Central Brasil (Glaziou No. 22272).

2. MAURITIA FLEXUOSA L. fil. suppl. 454 ; Meyer, Primit. Fl. Essequeb. 283 ; Mart. Hist. Nat. Palm. ii, 44, t. 40 and iii, 344 ; Wallace, Palm trees Amaz. 47 t. II, f. 2 and t. XVII ; Drude in Mart. Fl. Bras. iii, II. 291, t. LXII. f. II ; t. LXIV. f. II (?) ; t. LXV, f. I et LXVII f. II.

Equatorial cis-Andine America.

3. MAURITIA ACULEATA H. B. K. Nov. Gen. i, 311 ; Humb. Ansichten der Natur. 131 ; Wallace, Palm trees Amaz. 55, t. XIX ; Spruce, Palmae Amaz. 169 ; Drude in Mart. Fl. Bras. iii, II, 292 (partly and excl. t. LXII. f. IV ?).

Lepidoccocus aculeatus Wendl. et Drude in Kerch. Les Palm. 249.

Brasil, Canton of the Rio Negro.

4. Mauritia armata Mart. (non Humb.) Hist. Nat. Palm. ii, 45, t. 41, 42. (excl. t. 43 ?) et iii, 344 and Palm. Orbign. 20, t. 14 et 21; Spruce, Palm. Amaz. 170; Drude in Mart. Fl. Brasil iii, II, 294 (et t. LXII f. V fructus?).

M. Martiana (non Spruce) Drude in Mart. Fl. Bras. iii, II, t. 65 II?

Lepidococcus armatus Wendl. et Drude in Kerch. Les Palm. 249.

Central Brazil (Minas Geraes, Goyaz).

5. Mauritia Carana Wallace, Palm trees Amaz. 53, t. XVIII; Spruce Palm. Amaz. 171.

Orophoma Carana (Spruce) Drude in Mart. Fl. Bras. iii, II, 295, t. LXVI, f. II.

Rio Negro and Upper Orinoco.

6. Mauritia Martiana Spruce Palm. Amaz. 170. 171; Drude in Mart. Fl. Bras. iii, II. 293 (partly).

M. aculeata Mart. (non Humb.) Hist. Nat. Palm. ii, 47 (partly as to the descript?) t. 39, f. III. IV et t. 44 (probably also t. 43 under the name of *M. armata*).

Brasil, Lower Amazon.

7. Mauritia peruviana Becc. sp. n.

Oriental (cis-Andine) Peru.

8. Mauritia subinermis Spruce, Palm. Amaz. 171.

Orophoma subinermis Drude in Mart. Fl. Bras. iii, II. 296. t. LVI. I.

Casiquiari and Guainia Rivers.

9. Mauritia gracilis Wallace, Palm trees Amaz. 57. t. XX.

M. limnophila Barb. Rodr. Enum. Palm. Nov. 18 et Sertum Palm. i, 9, t. 2—3.

M. amazonica Barb. Rodr. Expl. Vallée des, Amaz., Rio Urube. 1875, p. 43 ex Sertum Palm. l. c.

Brasil, Amazon.

10. Mauritia pumila Wallace, Palm trees Amaz. 59, t. XXI; Drude in Mart Fl. Bras. iii, II. 294.

Lepidococcus pumilus Wendl. et Drude in Kerch. Les Palm. 249.

Upper Rio Negro.

11. Mauritia setigera Griseb. et Wendl. in Gris. Fl. of the Brit. West Ind. Isl. 515.

Trinidad. Gregarious and forming the chief vegetation in the swampy parts of the island. Barbados?

12. Mauritia peruviana Becc. n. sp.

Trunk solitary (?) attaining the height of 20 m. *Leaves* deeply parted into numerous narrow long-acuminate segments, the largest 75—80 cm. long, 2·5 cm. broad, green above, white waxy-pulverulent and sprinkled with small brown hair-like scales beneath; the margins and the mid-costa smooth. *Male spadix* large, 1·50 m. long; spathes of the spike-bearing branches broadly infundibuliform, 6—7 cm. long and about equally broad at the mouth. Spikelets short, arched-spreading, the lowest and largest about 1 cm. long and carrying 18—20 flowers. *Male flowers* oblong, blunt, 6 mm. long, 3 mm. broad; the calyx scaly-scurfy; stamens 6, not distinctly biseriate. *Female spadix* and fruit unknown.

Habitat.—Collected by Dr. A. Weberbauer in September 1904 in Eastern Peru at Rioja, to the West of Moyobamba (Department of Loreto), growing in woody savannah, between 800—900 m. above the level of the sea (No. 4717 in the Herbarium at Berlin). It seems rather closely related to *M. armata.*

Latin Diagnosis.—Mauritia peruviana Becc. sp. nov. Trunco solitario (?) circiter 20 m. longo; frondibus profunde multipartitis, segmentis angustis, longe acuminatis, majoribus 75—80 cm. longis, 2·5 cm. latis, subtus albido-pulverulentis, et squamulis brunneis minutissimis obsitis; costa media et marginibus laevibus; spadice masculo 1·50 m. longo; ramorum spathis late infundibuliformibus, 6—7 cm. longis et (in ore) latis; spicis brevibus, majoribus, 7 cm. longis, 18—20-floris; floribus masculis 6 mm. longis, 3 mm. latis.

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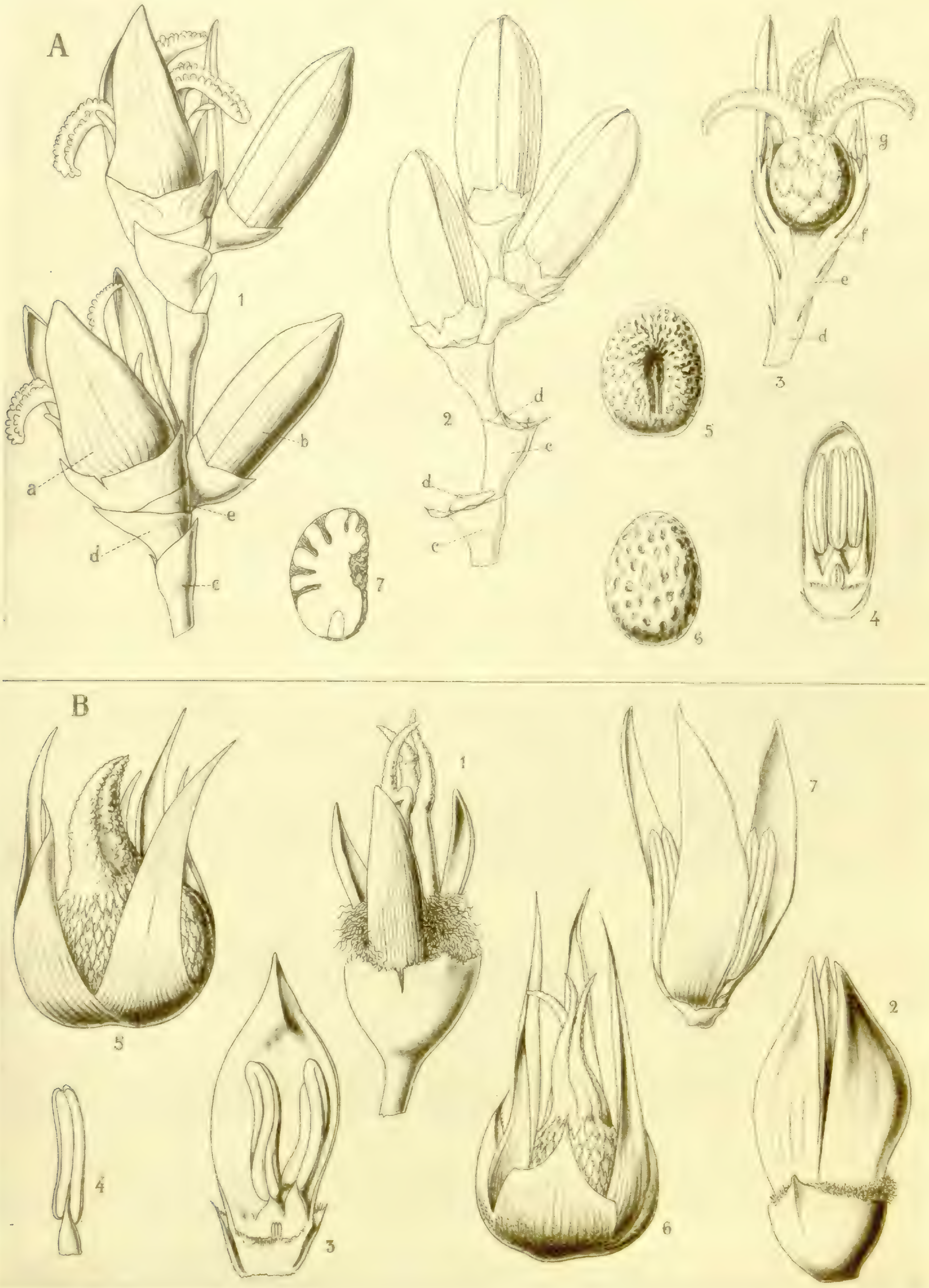

A – FIG. 1-4. CERATOLOBUS GLAUCESCENS, Bl. — FIG. 5-7. C. CONCOLOR, Bl.

B – FIG. 1-4. PLECTOCOMIA ELONGATA, Mart. et Bl. — FIG. 5. Pl. BRACTEALIS, Becc. — FIG. 6. Pl. ASSAMICA, Griff. — FIG. 7. Pl. KERRANA, Becc.

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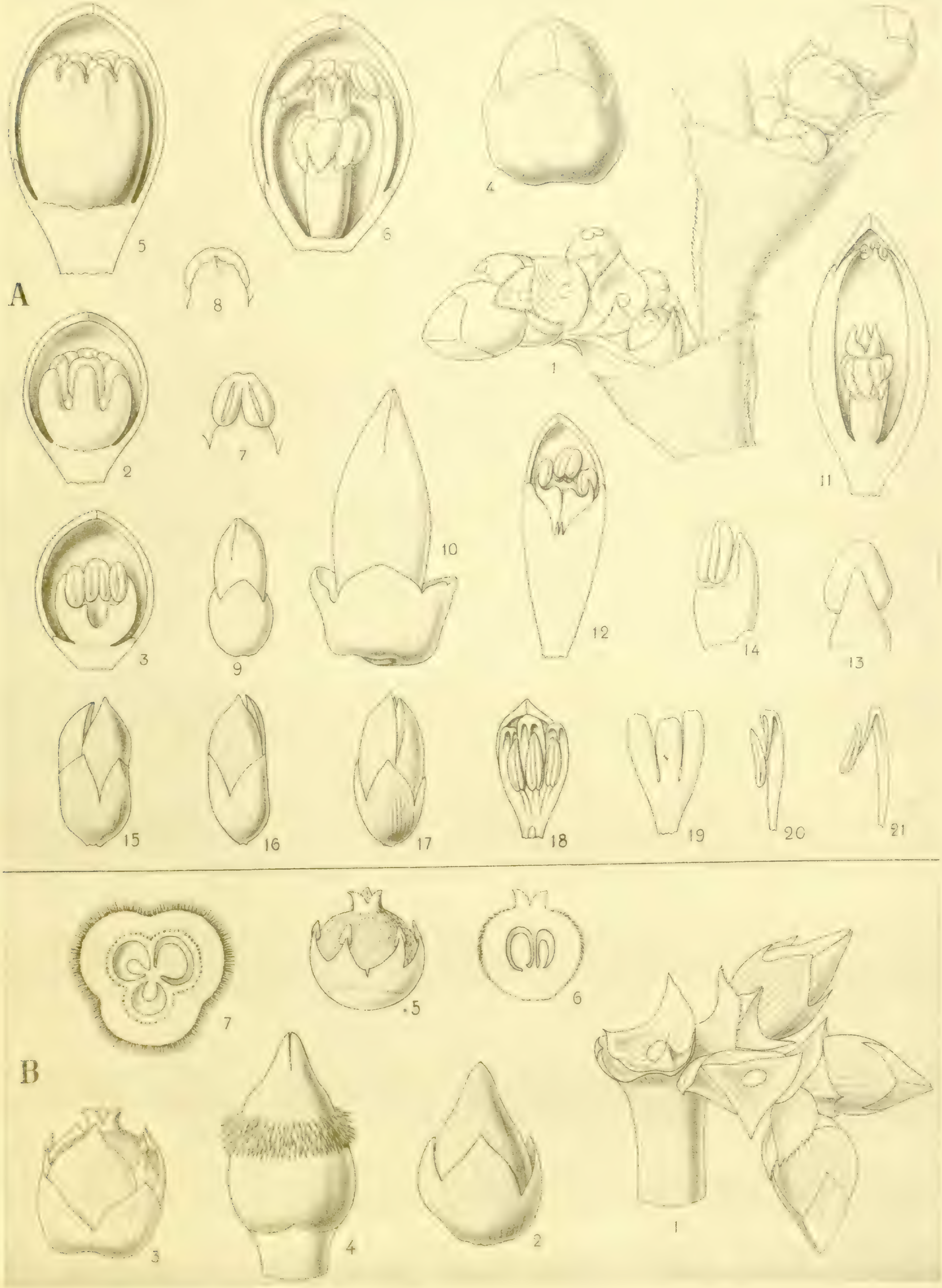

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B – FIG. 1-7. MYRIALEPIS SCORTECHINII, Becc.

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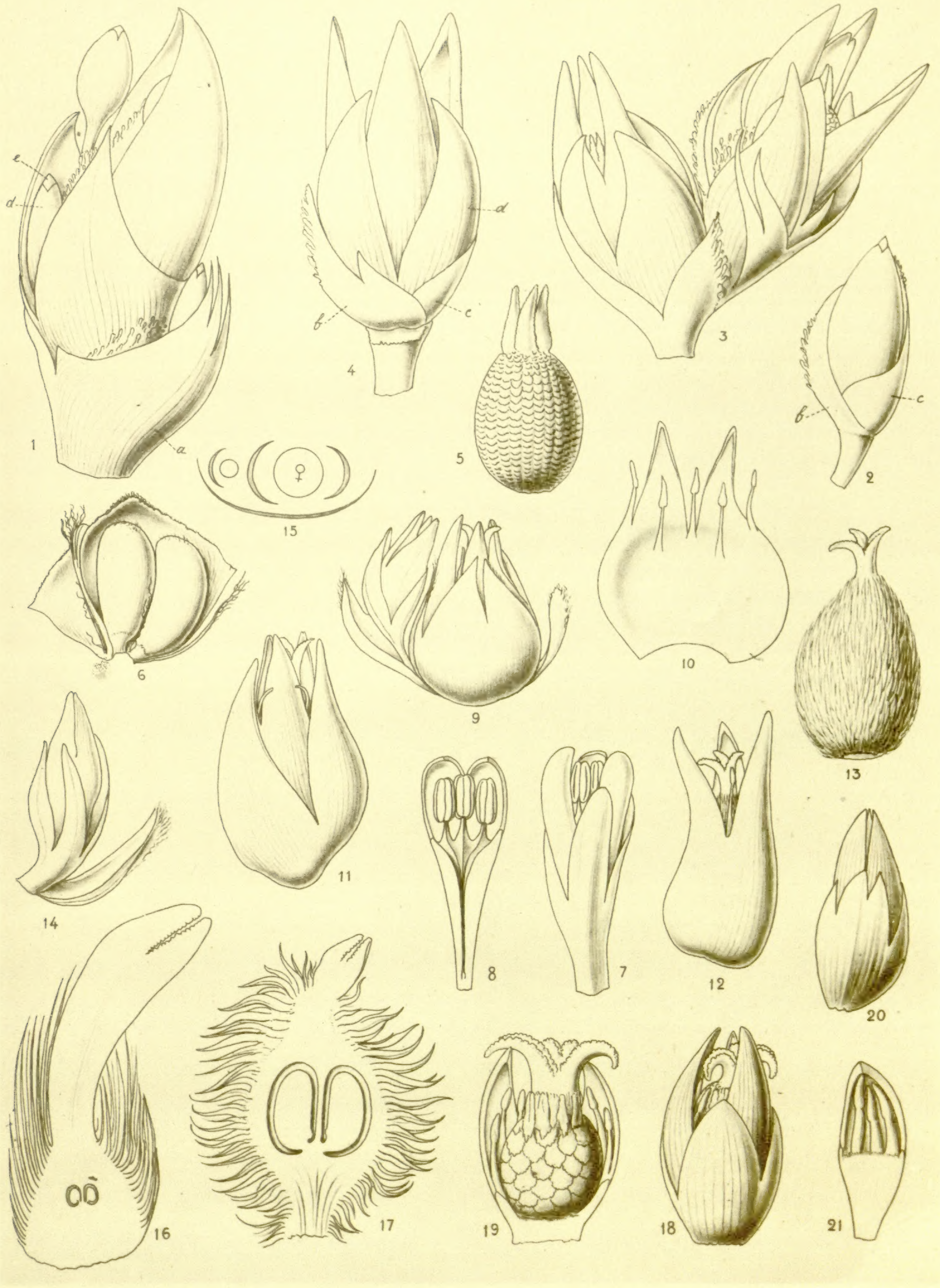

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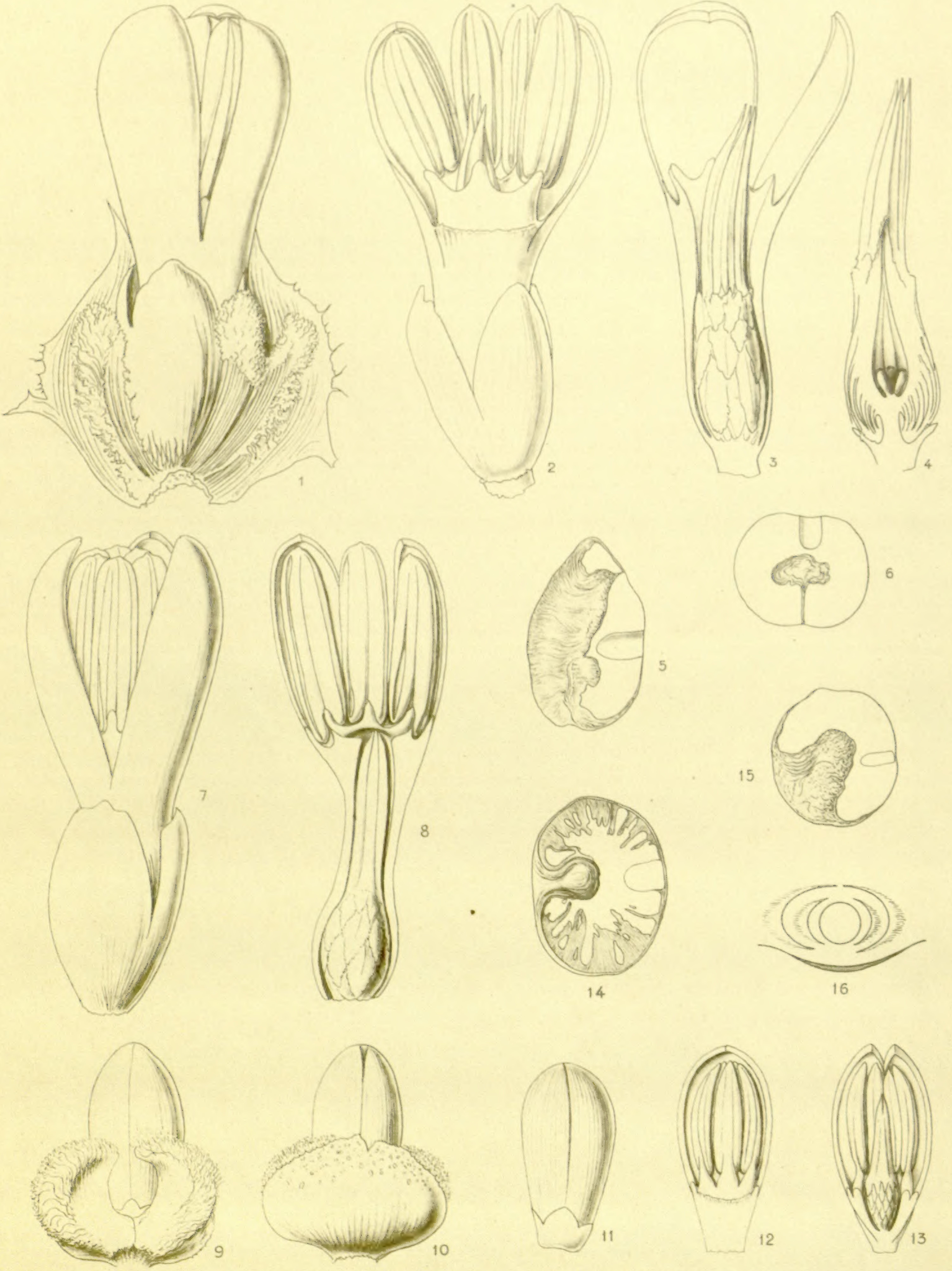

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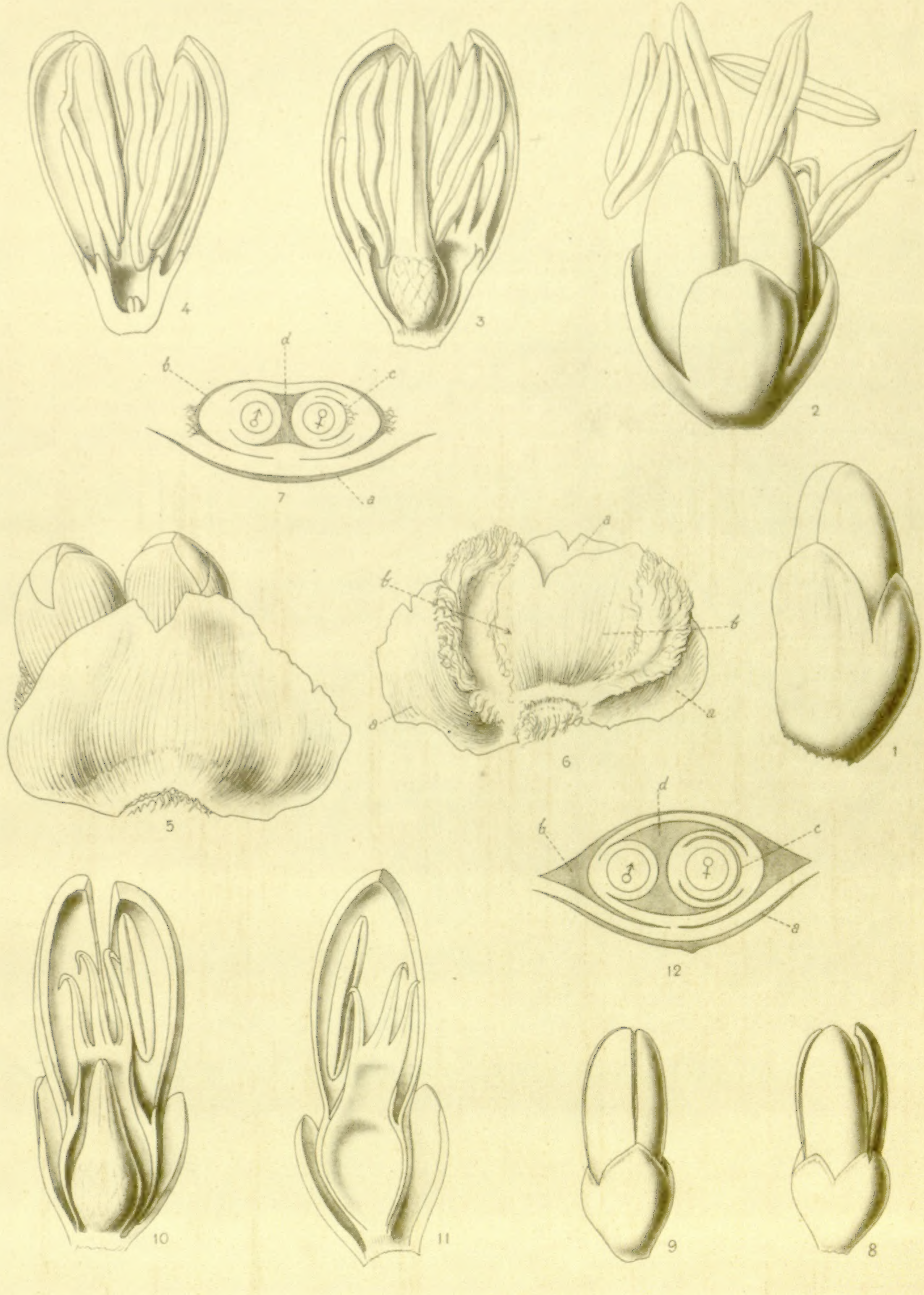

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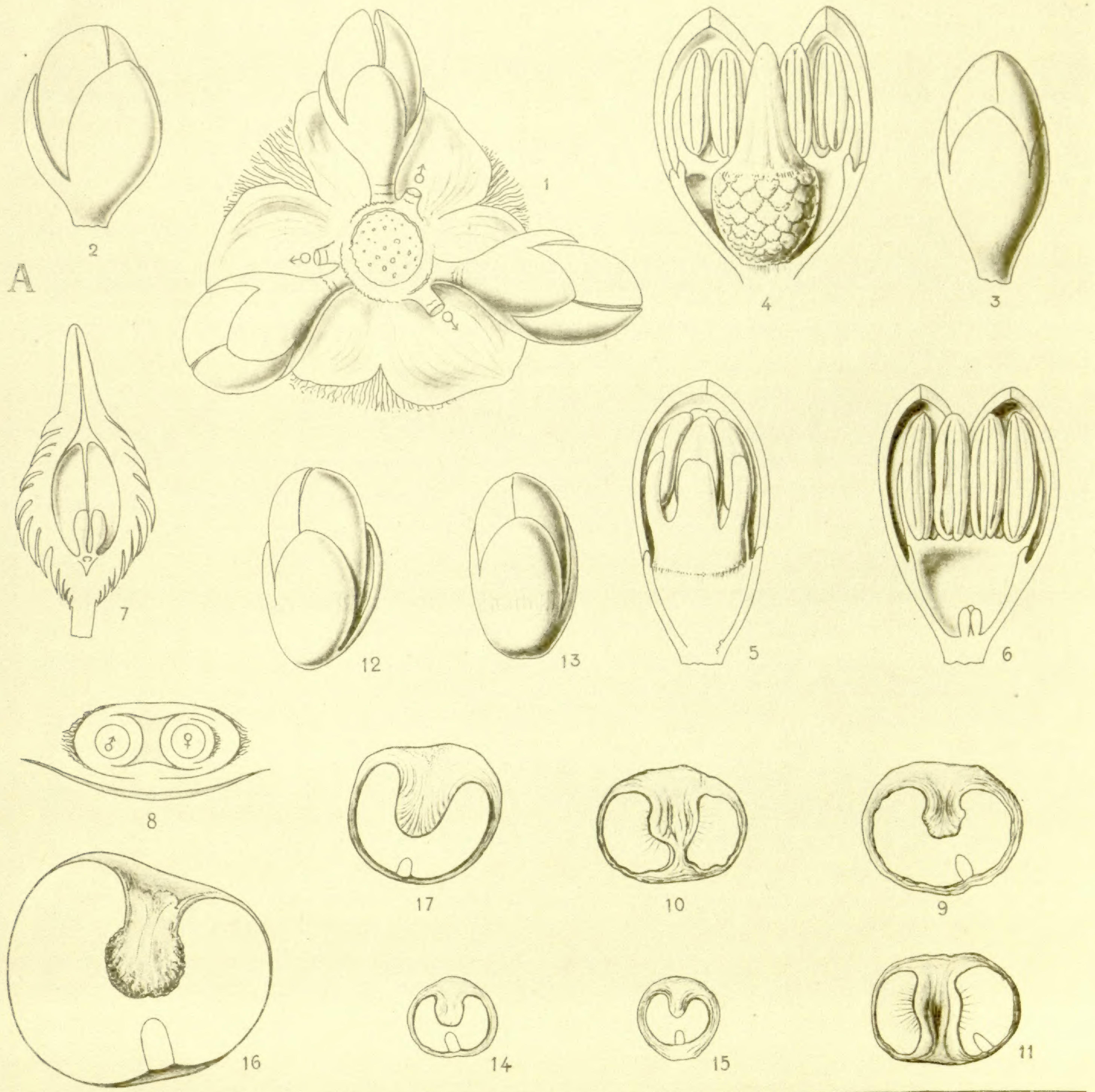

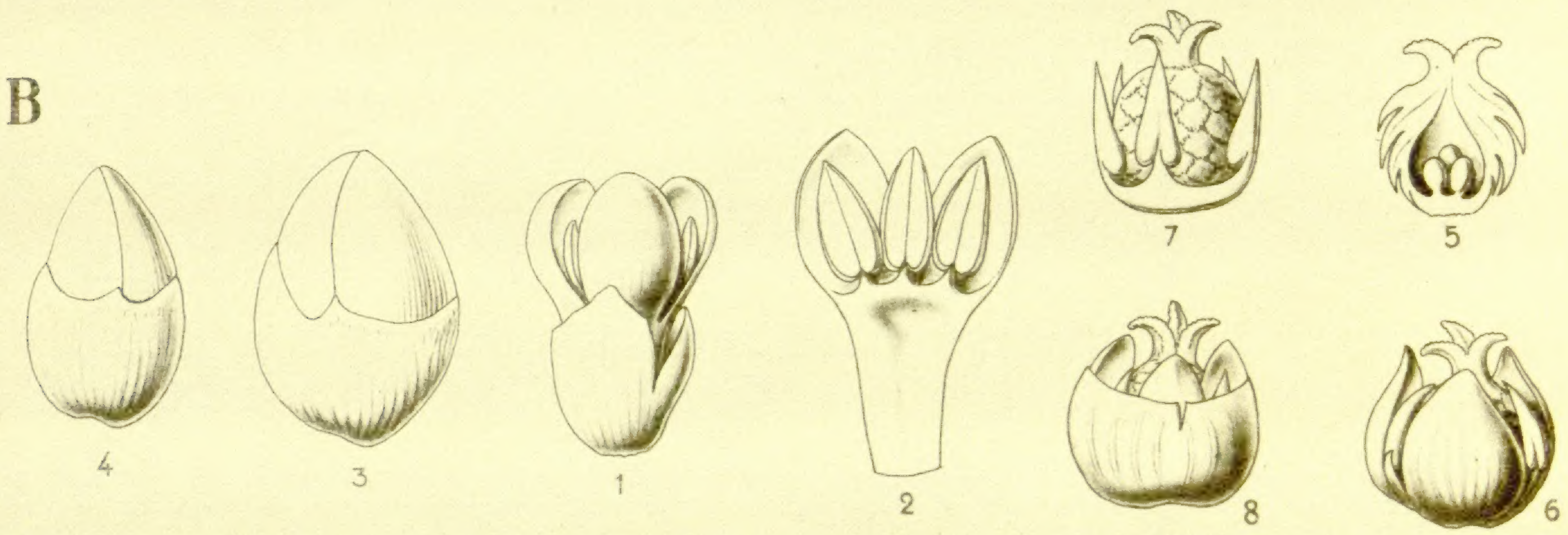

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